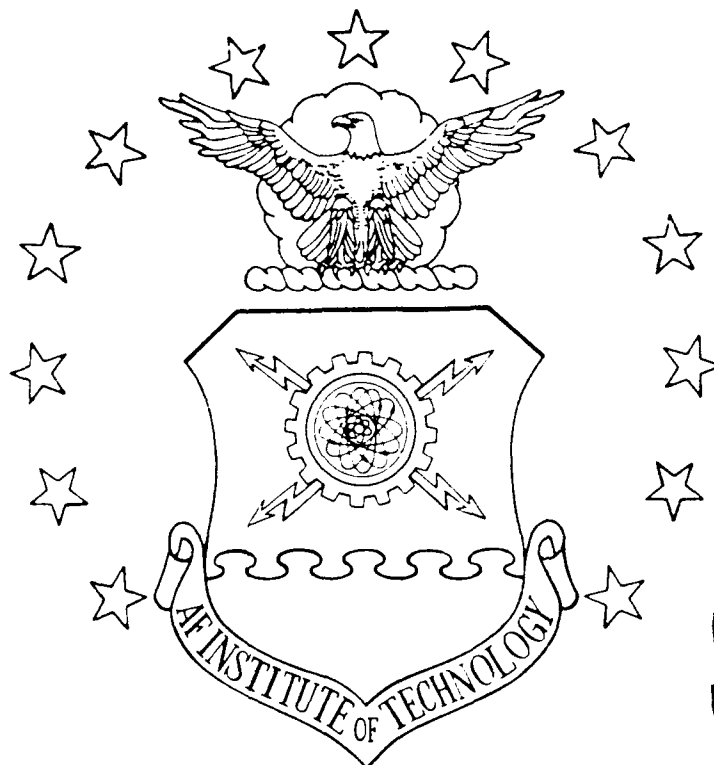


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AN EXAMINATION AND COMPARATIVE STUDY  
OF JOB CHARACTERISTICS LEVELS AND  
INTERNAL WORK MOTIVATION AMONG  
U.S. AIR FORCE NAVIGATORS BASED ON  
AIRCRAFT AND TYPE OF MISSION FLOWN

THESIS

Michael A. Urban, Captain, USAF

AFIT/GLM/LSR/89S-68

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AN EXAMINATION AND COMPARATIVE STUDY OF JOB CHARACTERISTICS

LEVELS AND INTERNAL WORK MOTIVATION AMONG U.S. AIR FORCE

NAVIGATORS BASED ON AIRCRAFT AND TYPE OF MISSION FLOWN

THESIS

Presented to the Faculty of the School of Systems and Logistics  
of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the  
Requirements for the Degree of  
Master of Science in Logistics Management

Michael A. Urban

Captain, USAF

September 1989

Approved for public release; distribution unlimited

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Abstract

The purpose of this study was to determine the job characteristics levels of US Air Force navigators as indicators of internal work motivation and job satisfaction. This research accomplished two broad objectives. First, navigator job characteristics in all flying commands throughout the Air Force were assessed to obtain an aggregate measure of that career field's work motivation. Second, the effects of aircraft type and mission performed on the job characteristics levels of different categories of Air Force navigators were examined in order to assess the possibility of varying attitudes within the career specialty.

Data was obtained from a popular survey instrument (Job Diagnostic Survey) and was interpreted in the context of behavioral/organizational theory.

Analysis of the survey data found that Air Force navigators, as an aggregate group, are equal to the national averages in most areas of job satisfaction. Despite the conclusion above, four major problem areas were found to be below the national norms: autonomy, growth satisfaction, job security, and pay satisfaction. The highest level of discontent was generated in the area of pay satisfaction almost entirely as a result of the pilot incentive bonus.

In terms of the aircraft-differentiated comparisons, fighter-type navigators seem to possess higher levels of internal work motivation and job satisfaction than do multi-place navigators. The mission-differentiated comparisons found tactical airlift navigators to be the most satisfied group overall while the tanker/strategic airlift group was found to be the most dissatisfied and in need of a job redesign.

This study recommended fundamental changes in the navigator-pilot relationship to include redefining the concept of the aircraft commander and allowing navigators to function as mission commanders as some navigators do in the US Navy. Moreover, possible future areas of related study were described.

AN EXAMINATION AND COMPARATIVE STUDY OF JOB CHARACTERISTICS  
LEVELS AND INTERNAL WORK MOTIVATION AMONG U.S. AIR FORCE  
NAVIGATORS BASED ON AIRCRAFT AND TYPE OF MISSION FLOWN

I. Introduction

General Issue

In 1985, a thesis conducted by Captains Dotson and Hilbun found a high degree of job dissatisfaction among Strategic Air Command (SAC) navigators and documented a need for a job redesign of that career specialty. Such findings are significant in light of the fact that navigators in SAC and other operational commands are indispensable to the Air Force flying mission. Widespread dissatisfaction in this group could result in long term retention problems, a lack of commitment to Air Force goals, and lowered productivity.

Problem Statement

Dotson and Hilbun examined job characteristics levels of SAC navigators to determine the applicability of job enrichment to that career field. Specifically, job characteristics levels were determined from one of the most widely used survey instruments for the measurement of job characteristics, the Job Diagnostic Survey, (JDS) (Hackman and Oldham, 1974:5-23), and the results were assessed within the framework of the Job Characteristics

Model (JCM) (Hackman and Oldham, 1980:75-90). Low scores were obtained on numerous job characteristics and the entire career field was found to possess a need for job redesign (Dotson and Hilbun, 1985:63-69).

Due to the seriousness of Dotson and Hilbun's findings, this research sought to accomplish two broad objectives. First, it was deemed necessary to conduct an updated version of Dotson and Hilbun's work in order to examine the validity of their negative job attitude assessment of SAC navigators. This research addressed the same general issues in a more comprehensive fashion by examining navigator job characteristics levels in all flying commands throughout the Air Force rather than in a single command. This expansion of the survey group was undertaken to determine the applicability of Dotson and Hilbun's findings about SAC navigators to the entire Air Force navigator population.

The second broad objective of this research effort was to examine the effects of aircraft type and mission performed on the job characteristics levels of different categories of Air Force navigators. In the author's nine year's of experience as a navigator in two types of aircraft, distinct differences were evident among sub-groups within the career field. It was felt that Dotson and Hilbun's classification of all SAC navigators as a single entity did not address this possibility of varying attitudes within the job specialty. While probably correct as an aggregate measure of navigator job satisfaction in SAC, Dotson and Hilbun's study oversimplified the job attitudes of the

navigator career field and did not accurately reflect the feelings of many navigators in the Air Force. Thus, this analysis and comparative study has determined the job characteristics levels of numerous navigator sub-groups in order to identify potential factors (such as aircraft type) that may be associated with higher or lower levels of job satisfaction.

### Research Hypotheses

In the author's experience, navigators serving in crew-type, multi-place aircraft (KC-135, C-130, C-5, B-52) generally feel that they lack the autonomy to make important decisions and often feel stifled by a perception of limited growth potential in comparison to pilots at the same career point. Often, these navigators feel like technicians performing machine-like tasks and, as a result, possess negative feelings about the flying mission and their jobs in general.

Once again, based on the operational experiences of the author, navigators in two-seat, fighter-type aircraft (F-111, F-4, SR-71, F-15E) are generally more satisfied than their counterparts in multi-place aircraft, even though some of the same concerns affect both groups. Higher levels of motivation, job satisfaction, and perceived autonomy would be expected from this group.

This study also examined the impact of the mission environment on the job characteristics levels of the various navigator groups. Different aircraft, squadrons, and commands

fly numerous types of mission profiles which require varying degrees of complexity and ability. For instance, the high speed, low-level strike missions of the F-111 series of aircraft are generally more demanding and stressful than are the high altitude refueling missions accomplished by KC-135 tanker aircraft. Additionally, many of the low level missions are more diverse and less repetitive than are the standard high altitude profiles of tanker and cargo aircraft.

According to the analysis of A. H. Maslow in the area of motivational research, one might expect those navigators involved in challenging, less-repetitive mission profiles to be more satisfied with their jobs than those individuals flying less-demanding sorties. Such would be the case due to the desire by human beings to satisfy the higher level needs of "esteem and self-actualization" (Maslow, 1954:26-40).

This research tested the above hypotheses in a two-pronged examination of job characteristics levels and navigator job redesign potential. Given the correctness of the stated hypotheses, one might have expected those navigators in the more challenging job positions to have more positive attitudes than those not in such positions. The significance of positive job characteristics levels in a specific sub-group would suggest the possibility of applying those "satisfiers" unique to that group to other less satisfied groups through job enrichment or redesign.

### Investigative Questions

In addressing the hypotheses stated above, the following questions were considered:

1. What are the motivation, job satisfaction, growth potential levels, and job characteristics levels of the average Air Force navigator as indicated by Hackman and Oldham's Job Diagnostic Survey (JDS) and the Job Characteristics Model (JCM) (Dotson and Hilbun, 1985:3)?
2. How do the above measures compare with the national norms as established by the JDS (Hackman and Oldham, 1974:23); and, how do these same measures compare to the results obtained by Dotson and Hilbun's 1985 research effort?
3. How do factors such as aircraft type and the type of mission flown relate to higher or lower levels of job satisfaction (Dotson and Hilbun, 1985:3)?
4. Based upon analysis of the above measures, is there a need for redesign of the entire navigator career field or only selected segments of the population? If a need for redesign is documented, what is the potential for accomplishing a job redesign in the identified group (Dotson and Hilbun, 1985:3)?

### Scope

Active duty Air Force officers from first lieutenant through

major who are currently performing navigator duties or duties directly related to the navigator career field (Duty Air Force Specialty Code (DAFSC) 15XX) were surveyed using the JDS. Also included in the survey population were those officers designated as flight test navigators (DAFSC 2875). Electronic warfare officers (DAFSC 1575 and 1595C), however, were excluded from this research effort despite the fact that they possess a navigator rating.

These decisions were made to limit the surveyed population to those individuals who are directly involved with the navigator career field at present, not those involved in some past or future endeavor. Specifically, the rank structure selected for this project sought to exclude those individuals who had not yet formed realistic attitudes about the job (second lieutenants) and those navigators involved more in a command capacity (lieutenant colonels and above) than in performing navigation/weapons duties.

The survey group was also limited by the stipulation that the Duty Air Force Specialty Code (DAFSC) be used in lieu of the Primary Air Force Specialty Code (PAFSC). Often, navigators with extensive flying experience will career broaden to a non-flying headquarters position or temporarily move to the acquisition/logistics community. These individuals will normally retain a navigator PAFSC while simultaneously possessing a DAFSC that reflects their present position. Thus, the decision to use the DAFSC meant that only those navigators currently working in a navigator or a closely related position could be selected for



this research.

The final decision to include navigators of the test community in the survey, but not electronic warfare officers (EWO), was based on the fact that test navigators perform navigator-type duties while EWOs perform very specialized duties which are generally not associated with navigator/weapons activities.

Job dissatisfaction or low job characteristics levels can result from any number of causes and this research did not attempt to be all inclusive. Moreover, this study does not claim to be an exhaustive review of all research completed in this field.

Another significant point about this research is that it was not intended to develop a program of job enrichment for the navigator career field or any sub-group. Rather, the intent was to examine and compare the job characteristics levels of the current Air Force navigator population (and various sub-populations) in light of the negative results obtained by Dotson and Hilbun in 1985. Time constraints dictate that the development of a navigator job enrichment program remain a possible area of future research.

### Limitations

This study was a comprehensive examination and comparison of the job characteristics levels of navigators found throughout the U.S. Air Force. Navigators are widely used in the Strategic Air

Command (SAC), the Tactical Air Command (TAC) and its overseas components, Military Airlift Command (MAC), and some of the support commands. Because the author's experience has been almost entirely in SAC, insight into the feelings of those navigators in other commands was somewhat limited. This limitation was overcome by numerous consultations with navigators possessing the needed command experience. Additionally, much insight into the other commands was obtained from the narrative portions of the survey written by the respondents.

A second limitation of this study was the seemingly daily rumors of change and budget cuts relating to particular U.S. Air Force weapons systems. In the author's experience, rumors, change, and political decisions are inherent to government service, but the potential for navigator career upheaval is great at present. A good example of such change is the current proposal to transfer SAC's FB-111 fighter-bomber permanently to the tactical air forces at an undecided location and date. This decision has caused consternation among this group of navigators because the future of these officers has yet to be determined. Other examples of uncertainty include the eventual retirements of the F-4 fighter and the B-52 bomber. Both of these aircraft employ large numbers of navigators and will be replaced by those aircraft not requiring a navigator (F-16 fighter) or by those requiring substantially fewer navigators (B-1B bomber, F-15E fighter-bomber). This factor for change was viewed as a limitation of this research due to the possibility that some of

the data could be skewed negatively for a short period of time and bias the results.

### Summary

This chapter presented the two broad objectives of this research effort:

- 1) To examine navigator job characteristics levels in all of the flying commands throughout the U.S. Air Force; and
- 2) To examine and compare the effects of aircraft type and mission performed on the job characteristics levels of different categories of Air Force navigators.

After a discussion of previous research and the above objectives, specific research hypotheses were enumerated and investigative questions to answer the hypotheses were posed. Moreover, the scope and limitations of this research were also discussed.

## II. Literature Review

### Early Schools of Thought

With the advent of Scientific Management at the turn of the century, scientific observation and experimentation became the dominant features of industry. The purpose of methods such as time and motion studies was to discover that "single best way" of completing a task. Moreover, workers were seen as units of labor that could be bought and sold as management saw fit. The reason for such an approach was that workers were determined to be economically motivated and, thus, could be kept satisfied through various incentive work plans such as piece rates (Taylor, 1911:5).

After the onset of the Great Depression, a second school of thought called Human Relations Theory began to evolve. Associated with Elton Mayo and his Harvard colleagues, the concepts of the human school originated as a direct result of the famous Hawthorne studies. Because of these studies, Mayo began to take issue with some of the basic tenets of Scientific Management and the so-called "rabble hypothesis" (Mayo, 1945:23). In place of the rabble hypothesis, Mayo substituted the view that man was a social creature with strong instincts of human association and was not primarily motivated by economic self-interest. Because man could be viewed as being naturally disposed to cooperate, one of management's tasks was to provide organizational groupings in which workers could satisfy this

desire. Moreover, the organization was to be developed around the workers and had to consider human feelings and attitudes (Mayo, 1945:25). These studies eventually led to other areas of research such as motivation theory and job enrichment.

According to Hersey and Blanchard, the scientific movement emphasized a concern for task or output, while the human relations movement stressed a concern for relationship or people. The recognition of these two concerns has characterized the writings on leadership ever since the conflict between the scientific and human relations schools of thought became apparent (Hersey and Blanchard, 1982:85).

#### Maslow and the Hierarchy of Needs

It has been argued that the behavior of individuals at a particular moment is usually determined by their strongest need. Abraham Maslow has developed a motivational theory based on this premise that helps to explain how these needs affect individuals and their behavior. According to Maslow, there are five broad categories of needs that can be arranged into a hierarchy:

1. Physiological needs
2. Safety (Security) needs
3. Social (Affiliation) needs
4. Esteem (Recognition) needs
5. Self-Actualization needs (Hersey and Blanchard, 1982:27).

Some descriptions of Maslow's theory may portray the model

in pyramid fashion with the self-actualization needs at the top and the physiological needs at the bottom of the structure. In this case, however, the physiological needs are displayed at the top of the hierarchy because they must be satisfied first before other human needs can be considered. In essence, these needs are the primary motivators to sustain human life. Without food, clothing, and shelter, an individual will not be motivated to seek higher order goals (Hersey and Blanchard, 1982:27).

Once these basic physiological needs are satisfied, the safety or security needs become the central focus of an individual. These needs are essentially the need to be free of the fear of physical danger and the deprivation of the basic physiological needs. Specifically, this need is exhibited as a desire for self-preservation. Hersey and Blanchard maintain that these security needs are not only concerned with the present, but are also future-oriented. "Will people be able to maintain their property and/or job so they can provide food and shelter tomorrow and the next day? If an individual's safety or security is in danger, other things seem unimportant" (Hersey and Blanchard, 1982:27-29).

Once safe and physiologically satisfied, a person will strive to satisfy his/her social or affiliation needs. Because people are social beings, they have a need to belong and be accepted by various groups. When affiliation needs begin to dominate, a person becomes interested in being accepted by his/her peers and in developing meaningful relationships with others.

Satisfaction of these needs for belonging will then lead to a desire by the individual to foster a positive self-image and recognition from others; i.e., esteem. Associated with the satisfaction of these esteem needs are the feelings of self-confidence, prestige, power, and control (Hersey and Blanchard, 1982:28-31).

Once all of the four lower needs are sufficiently satisfied, the need for self-actualization becomes predominant. According to Maslow, "self-actualization is the need to maximize one's potential, whatever it may be. A musician must play music, a poet must write, a general must win battles, and a professor must teach" (Maslow, 1954:26-30). Thus, the individual will strive to reach his or her maximum potential as a human being.

After examining Maslow's framework, one must be careful not to apply the five categories too stringently. In reality, most individuals in society today may have all levels of need operating at one time, with greater levels of satisfaction occurring in the physiological and safety levels. Thus, this hierarchy of needs should be viewed as a dynamic model that is useful in predicting broad behavior patterns on a probabilistic basis rather than as a static instrument that exactly reflects the motivation potential of all people (Hersey and Blanchard, 1982:29-30).

Application of Maslow's motivational framework to the navigator career field can be most optimally seen in the perception of uncertainty that some navigators have toward their

job. Specifically, senior leaders and commanders should realize that uncertainty about the future in any career field focuses an individual on the lower level needs of safety or security. Ideally, these navigators should be focused on the higher order needs of esteem and self-actualization if they are to achieve their full potential as officers and leaders in the Air Force.

#### Theory X and Theory Y

Adapting Maslow's theory and some of the works of Elton Mayo, Douglas McGregor developed the well-known "Theory X-Theory Y" framework of motivational behavior. According to McGregor, there exist two opposing views of human nature that managers may exhibit in their dealings with subordinates. Theory X assumes that most people prefer to be directed and that work is inherently distasteful. Additionally, most workers are not ambitious, would rather avoid responsibility, and are motivated by only the lower order needs; i.e., physiological and safety needs. Thus, leaders who have a predisposition toward Theory X often attempt to control and coerce their employees in order to get the job done (McGregor, 1960:79).

Theory Y was developed by McGregor as an alternate theory of motivational behavior to Theory X. The basic tenets of this theory are that people are not lazy and unreliable; can be self-directed and creative at work if properly motivated; and are motivated by the higher order needs as well as the physiological and security levels. (McGregor, 1960:79-81)



After describing these two theories, McGregor questioned the management application of Theory X in a modern, democratic society with an increasing level of education and a high standard of living. He also suggested that the basic Theory X motivators of coercion and control would fail to motivate many individuals to work toward organizational goals. Specifically, McGregor believed Theory X to be "a questionable method for motivating people whose physiological and safety needs are reasonably satisfied and whose social, esteem, and self-actualization needs are becoming predominant" (Hersey and Blanchard, 1982:48).

#### Motivation-Hygiene Theory

Motivation-Hygiene theory, as developed by Frederick Herzberg, is basically an offshoot of Maslow's hierarchy of needs in that the human needs of esteem and self-actualization are central themes. Herzberg used the terms motivators and hygiene factors to describe two types of motivational needs that promote different levels of job satisfaction (Table 1). Motivators such as recognition and increased responsibility can actually lead to esteem, self-actualization, and job satisfaction. Conversely, hygiene factors, such as pay and working conditions, do not lead to satisfaction or motivation. Rather, they promote only dissatisfaction when they are absent from the work environment. Thus, these hygiene factors represent Maslow's lower-order needs and do not, by themselves, lead to job satisfaction (Herzberg, 1967:114-120).

Table 1 - Motivation and Hygiene Factors

---

<u>Motivators</u> (The Job Itself)	<u>Hygiene Factors</u> (Environment)
Achievement	Policies and administration
Recognition for accomplishment	Supervision
Challenging work	Working conditions
Increased responsibility	Interpersonal relations
Growth and development	Money, status, security

---

(Hersey and Blanchard, 1982:58)

### Job Redesign

Prior to Herzberg's research, many other behavioral scientists were concerned with worker motivation. For several years there was an emphasis on what was termed job enlargement or job rotation to counter the negative effects of overspecialization that had characterized many industrial organizations. According to Hersey and Blanchard, the assumption was that workers could gain more satisfaction at work if their jobs were enlarged; i.e., "if the number or variety of operations in which they engaged was increased" (Hersey and Blanchard, 1982:61).

Commenting on this trend toward job enlargement, Herzberg concluded that job satisfaction and motivation do not necessarily result simply because an individual has been given a variety of tasks to accomplish. An automobile assembly-line worker who installs headlights, taillights, and door handles on vehicles is provided only a marginally higher level of growth potential and satisfaction than is a person installing only headlights. According to Herzberg, the key to motivating workers and

promoting satisfaction with work is not the enlargement of a particular job, but the enrichment of that job. Job enrichment or redesign can be thought of as the deliberate upgrading of responsibility, scope, and challenge in work (Hersey and Blanchard, 1982:61).

One of the first measures of job characteristics used in the determination of the need for job redesign was developed in 1965 by Turner and Lawrence. Their study examined the relationship between certain objective attributes of tasks and employee reactions to their work. Among the task attributes studied were the "amount of variety in the work, the level of employee autonomy in performing the work, the amount of interaction required in carrying out task activities, the level of knowledge and skill required, and the amount of responsibility entrusted to the jobholder" (Hackman and Oldham, 1980:59-60). A strong, positive relationship was found to exist between high scores on these attributes and the amount of job satisfaction a worker possesses. Thus, the research of Turner and Lawrence was actually the foundation of what is today one of the most widely accepted behavioral approaches to the design of work: Job Characteristics Theory (Turner and Lawrence, 1965:152-158).

Job Characteristics Theory was tested again in 1971 when Hackman and Lawler examined various telephone company jobs by focusing on four job characteristics: variety, task identity, autonomy, and job feedback. Once again, a direct relationship between the presence of these attributes and the level of

internalized, employee, work-motivation was found to exist. Moreover, the authors found evidence to explain inconsistencies first uncovered in Turner and Lawrence's research. Specifically, the authors discovered that "the stronger an individual's need for growth, the more likely he or she would be to respond positively to a job high on the four core dimensions" (Hackman and Oldham, 1980:60). In essence, different employees have individual needs for growth and development at work; therefore, job characteristics levels are moderated by the strength of the individual's growth needs. Succeeding research accomplished by Hackman and Oldham would include a variable to measure the growth need strength (GNS) of an individual (Hackman and Oldham, 1980:77).

#### Job Characteristics Model (JCM)

In 1975, Hackman and Oldham developed a conceptual framework for the comprehensive measurement of numerous job characteristics that are associated with high, internal work motivation. Their Job Characteristics Model (JCM) argued that, essentially, "enriched or complex jobs are associated with increased job satisfaction, motivation, and work performance" (Fried and Ferris, 1987:287).

In order to reach this desired outcome of high, internal work motivation, an individual must satisfy three key conditions called critical psychological states (Figure 1). First, the person must have knowledge of the actual results of his or her

work activities. After all, if one is to be satisfied and motivated at work, one must have an idea of how well he or she is performing his or her tasks (Hackman and Oldham, 1980:72-74).

Secondly, the individual must believe that he or she is personally accountable for the work outcomes if the next condition is to be fulfilled: Experienced responsibility for outcomes of the work. If the worker perceives the quality of work done as beyond his or her control, then there is probably no reason to feel proud or disturbed with the results of one's efforts (Hackman and Oldham, 1980:73).

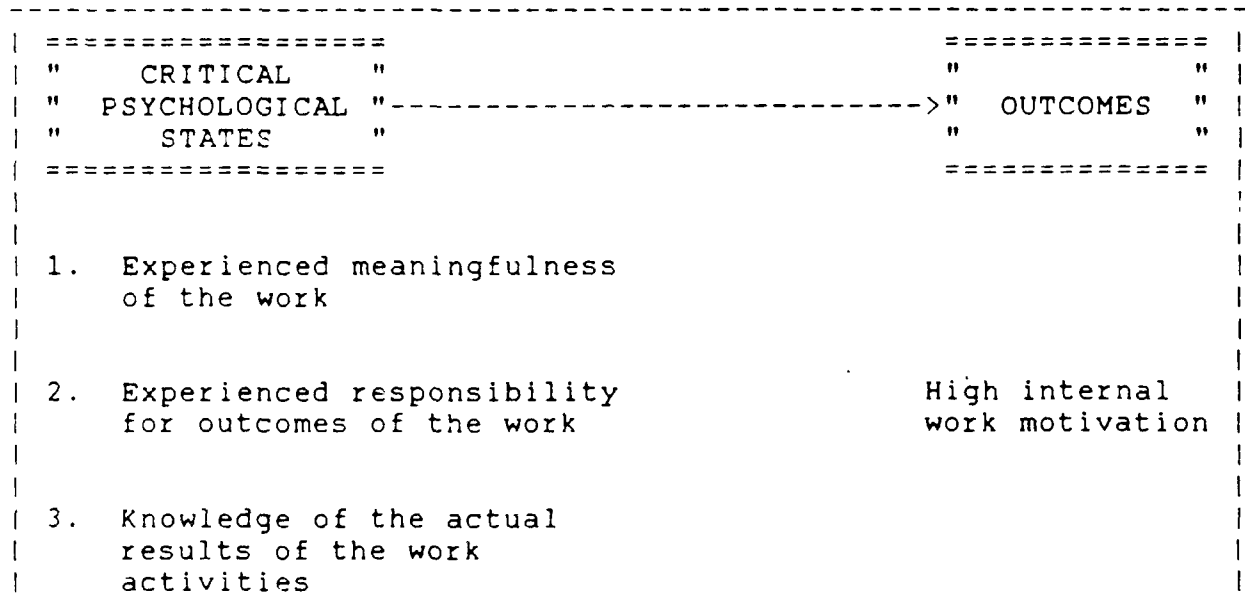


Figure 1. The three psychological states that affect internal work motivation (Hackman and Oldham, 1980:73).

Finally, the person must view his work as significant in the larger scheme of things if the third critical state is to be satisfied: Experienced meaningfulness of the work. If the work

being accomplished is perceived as trivial, "then internal work motivation is unlikely to develop - even when the person has sole responsibility for the work and receives ample information about how well he or she is performing" (Hackman and Oldham, 1980:73).

Hackman and Oldham suggest that these psychological states are, by definition, internal to persons and not able to be manipulated or changed directly to enhance an individual's work motivation. Previous research in the field of job characteristics theory has identified five core job characteristics that are reasonably objective, changeable measures of the work itself. These job characteristics promote achievement of the three psychological states and, in turn, help an individual to become self-motivated at work (Hackman and Oldham, 1980:77).

The JCM identifies the following measures as the five core job characteristics:

- 1) Skill variety: The degree to which a job requires a variety of different activities in carrying out the work, involving the use of a number of different skills and talents of the person (Hackman and Oldham, 1980:78).
- 2) Task identity: The degree to which a job requires completion of a "whole" and identifiable piece of work, that is, doing a job from beginning to end with a visible outcome (Hackman and Oldham, 1980:78).
- 3) Task significance: The degree to which the job has a substantial impact on the lives of other people, whether those people are in the immediate organization or in the world at large (Hackman and Oldham, 1980:79).
- 4) Autonomy: The degree to which the job provides substantial freedom, independence, and discretion to the individual in scheduling the work and in determining the procedures to be used in carrying it out (Hackman and Oldham, 1980:79).

5) Job feedback: The degree to which carrying out work activities required by the job provides the individual with direct and clear information about the effectiveness of his or her performance (Hackman and Oldham, 1980:80).

In terms of the critical psychological states already described in this chapter, the five core characteristics are grouped according to the specific feelings that each one promotes. The first three job characteristics (skill variety, task identity, task significance) seem especially powerful in influencing the experienced meaningfulness of work. A significant finding about the model, however, is that low scores on one or two of these three job characteristics do not necessarily identify a job as lacking in meaningfulness (Hackman and Oldham, 1980:79).

The job characteristic that "fosters increased feelings of personal responsibility for the work outcomes is autonomy" (Hackman and Oldham, 1980:79). When an individual views the job's end product as being substantially dependent on his or her initiatives and decisions, he or she will tend to feel more personally responsible for the successes and failures that occur on the job. These feelings will, in turn, make the "individual more willing to accept personal accountability for the outcomes of his or her work" (Hackman and Oldham, 1980:80).

The last core job characteristic, job feedback, is associated with the third of the three psychological states: knowledge of the actual results of one's work activities. The focus of this characteristic is on the feedback mechanisms that

are designed into the work itself (Hackman and Oldham, 1980:80). A pertinent example of such feedback might be the direct information a weapons systems operator receives from successfully evading enemy defenses and striking the assigned target.

In addition to determining each of the individual job characteristics, the JCM is also concerned with combining them into a single index that reflects the overall potential of a job to enhance internal work motivation. Termed the Motivating Potential Score (MPS) by Hackman and Oldham, the MPS is an attempt to use objective properties (job characteristics) to obtain an overall measure of the three psychological states. Specifically, numerical scores for the five core dimensions are combined as follows:

$$\text{MPS} = \frac{\text{Skill variety} + \text{Task identity} + \text{Task significance}}{3} \times \text{Autonomy} \times \text{Job feedback}.$$

One can see from the MPS formula that a very low score on either autonomy or job feedback will result in a substantially lower rating. This is consistent with the framework of the JCM which maintains that all three psychological states must be present if internal work motivation is to be enhanced. Similarly, low scores on any one of the first three job characteristics (skill variety, task identity, task significance) will not necessarily lower the overall motivating potential of a job. This result is possible because the other two characteristics that contribute to the experienced meaningfulness of the job may compensate for low



scores obtained on other characteristics within the same group (Hackman and Oldham, 1980:80-81).

Hackman and Oldham also recognized that individuals possess many attributes that affect how each person responds to his or her work situation. The JCM identifies three moderating variables that seem to be significant in differentiating potentially positive respondents from negative ones in high MPS jobs:

- 1) Knowledge and skill
- 2) Growth need strength (GNS)
- 3) Satisfaction with the work context (Hackman and Oldham, 1980:82-84).

According to the model, an individual who has sufficient knowledge and skill to perform well on a high MPS job will likely experience positive feelings as a result of his work experience. On the other hand, a person with no experience and a low skill level working at a high MPS job would experience frustration at work because of his inability to cope with a job perceived to be significant (Dotson and Hilbun, 1985:11).

The second moderator, growth need strength (GNS), refers to the need a worker has for personal accomplishment and growing beyond the present. When faced with a high MPS job experience, an individual with high growth needs should respond positively to such potential for personal growth. The low growth-need person, however, might not "recognize the existence of such opportunities, or might not value them, or might even find them

threatening and balk at being pushed or stretched too far by his/her work" (Hackman and Oldham, 1980:85).

Satisfaction with the work context is the last moderating variable included in the JCM and can be described as the degree to which a worker is satisfied with his pay, job security, co-workers, and supervisors. This variable is included in the conceptual framework of the model because of the mainly negative effect that it can have on job redesign efforts. For instance, a competent, high growth-need person, who is underpaid or due to be furloughed, would probably react negatively if he/she were faced with a proposal to make the job more challenging. Only if these contextual problems were solved or lessened, could such a worker become able to appreciate and respond with high internal motivation to enriched work. Like the hygiene factors of Herzberg's motivation-hygiene theory, Hackman and Oldham's work context tends to be a dissatisfier rather than a property that enhances internal work motivation (Hackman and Oldham, 1980:86-88).

Although the JCM focuses primarily on internal work motivation as the primary outcome of job redesign, Hackman and Oldham also identify three other significant outcomes of enriched work (Figure 2):

- 1) High growth satisfaction
- 2) High general job satisfaction
- 3) High work effectiveness.

The first and second outcomes are defined as personal outcomes by

the authors because they are associated with the personal satisfaction often reported by jobholders who are given enriched opportunities for learning and growth (Hackman and Oldham, 1980:89).

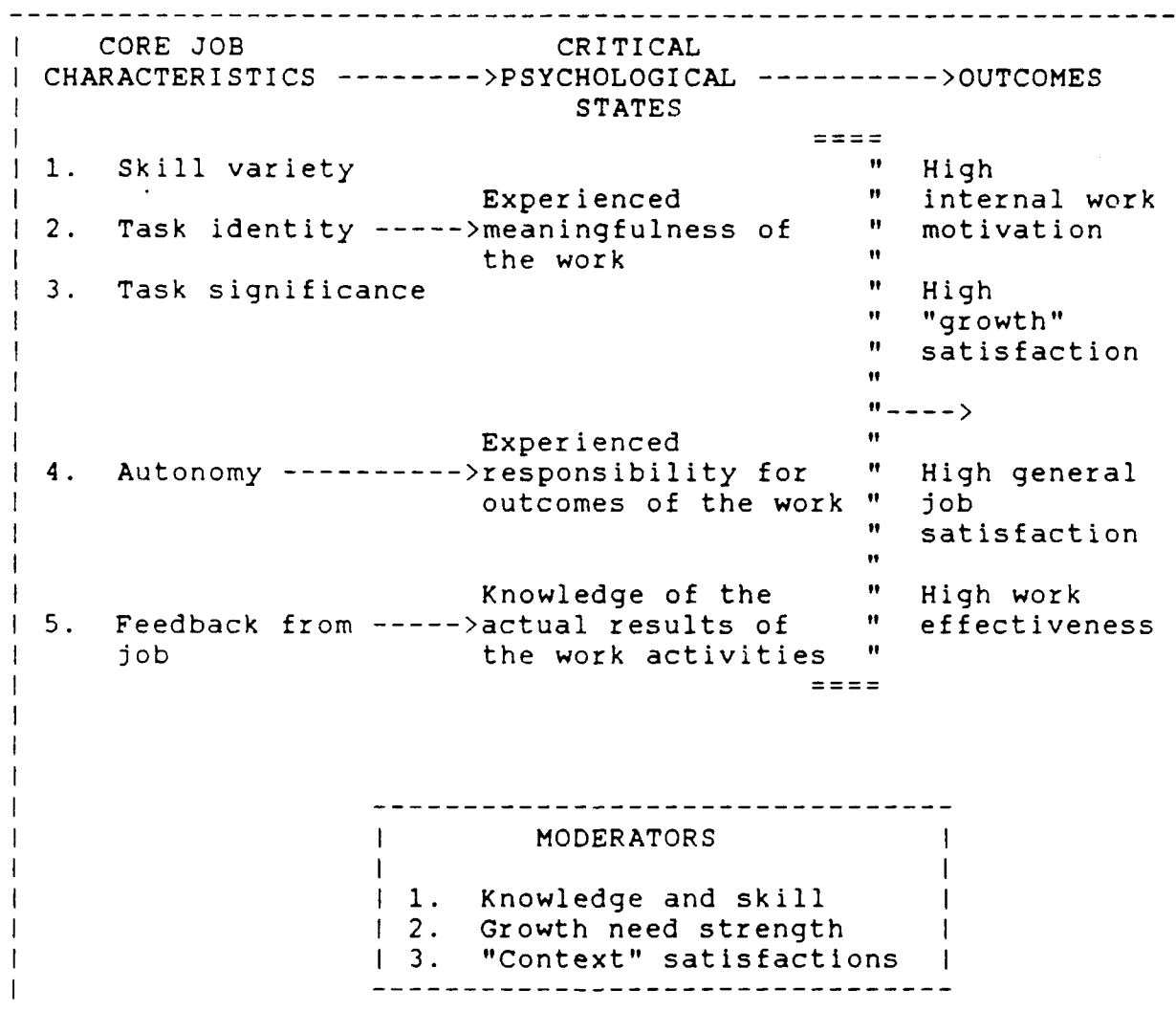


Figure 2. The complete job characteristics model (Hackman and Oldham, 1980:90).

The third outcome, work effectiveness, has been shown to improve in high MPS situations, especially in the quality of the work done. Improvements in production quantity, however, are not always assured unless motivational problems were severe prior to the job enrichment effort. Moreover, improvements in absenteeism and voluntary turnover were postulated by the authors, but little real measurement has been accomplished in this area of job redesign (Hackman and Oldham, 1980:94-95).

#### Validity of the Job Characteristics Model

In the past decade, a substantial increase in the amount of research conducted in the area of job design has occurred. The Job Characteristics Model has prompted much of this empirical research (Pierce and Dunham, 1976; Steers and Mowday, 1977; Aldag, Barr, and Brief, 1981; and Stone, 1986). According to Dotson and Hilbun, "Other researchers have used this model as a foundation for developing different job redesign theories (Katz, 1978; Griffin, 1980; and Umstot, Bell, and Mitchell, 1976)" (Dotson and Hilbun, 1985:12).

Criticism of the JCM in management literature has focused on several broad areas. First, numerous assessments of the JCM have criticized the fact that job characteristics typically have been measured through the perceptions of workers, and not through the use of more objective measures (O'Reilly and Caldwell, 1979; White and Mitchell, 1979). In a comprehensive review of nearly 200 relevant studies on the JCM, Fried and Ferris state that "the

data clearly suggest that objective and perceived job characteristics are related. Thus, one might legitimately conclude that it is inappropriate to totally dismiss perceptual and correlational results as simply artifactual in nature" (Fried and Ferris, 1987:309).

A second area of criticism of the model disputes the assumption that the job characteristics affect the outcomes through the psychological states. Roberts and Glick (1981) suggest that the JCM encourages a much stronger relationship between job characteristics and psychological states than between critical psychological states and psychological/personal outcomes. Once again, the comprehensive, empirical study of Fried and Ferris does not support this perspective. Moreover, Fried and Ferris conclude "that there is no rationale for the notion that common variance shared between psychological states and outcomes would be stronger than the common method variance between job characteristics and outcomes" (Fried and Ferris, 1987:311-312).

A third criticism of the JCM is that the effects of the moderator variables on the processes in the model are not thoroughly understood. Even Hackman and Oldham admit that "evidence for the proposed moderating effects is scattered" (Hackman and Oldham, 1980:95-96). They also state that the actual methodology for construing and measuring the differences in motivational readiness among individuals is very much an open question (Hackman and Oldham, 1980:97).

Hackman and Oldham's Job Characteristics Model has been reviewed and assessed by over 200 relevant studies since its creation in 1975. In the most comprehensive assessment of the model to date, Fried and Ferris applied meta-analytic procedures to a large portion of the data generated by those studies and concluded, "The evidence indicated that the available correlational results are reasonably valid in light of the issues examined" (Fried and Ferris, 1987:287).

Commenting on the validity of their model in describing internal work motivation, the authors of the JCM state: "Based on the evidence available, it is fair to say that the model probably is more right than wrong, but that it is surely inaccurate and incomplete in numerous specifics" (Hackman and Oldham, 1980:95).

#### Job Diagnostic Survey (JDS)

The principal assessment tool for purposes of measuring job characteristics is the Job Diagnostic Survey (JDS; Hackman and Oldham, 1974), which provides for the measurement of the five core job characteristics, the critical psychological states and work outcomes, and two moderator variables: growth need strength (GNS) and context satisfaction (Fried and Ferris, 1987:288).

In addition to its use as a convenient method of evaluating various parts of the JCM, the JDS is primarily utilized as a measure to assess the need and potential for work redesign in specific job situations. Hackman and Oldham compiled JDS score averages across 876 different jobs in 56 organizations (6930

employees). With this data, they categorized different job families (clerical, technical, sales, managerial, etc.) and established a set of national "norms" that can be used for comparison purposes (Dotson and Hilbun, 1985:13-15).

While the JDS is the most frequently used tool for the measurement of job characteristics, two other prominent self-report instruments are also found in the literature: The Yale Job Inventory (YJI), developed by Hackman and Lawler (1971), and the currently more popular Job Characteristics Inventory (JCI), developed by Sims, Szilagyi, and Keller (1976) (Fried and Ferris, 1987:288).

Experience with the JDS has highlighted a number of problem areas that must be discussed before using the instrument. These limitations have been generated by subjecting the JDS to extensive empirical testing over the last decade (Cathcart, Goddard, and Youngblood, 1978; Oldham, Hackman, and Stepina, 1979; Pierce and Dunham, 1978; Harvey, Billings, and Nilan, 1985; Fried and Ferris, 1987). Dotson and Hilbun reviewed the limitations and cautions associated with using the JDS:

1. The job characteristics measured by the JDS are not independent of one another and, as such, should not be interpreted on the basis of a single job characteristic (Dotson and Hilbun, 1985:14).
2. Despite the numerous validity assessments performed on the overall theoretical framework (JCM), the JDS still requires more review to insure that it measures what it is supposed to measure (Dotson and Hilbun, 1985:14).
3. The JDS is not appropriate in diagnosing the job of a single individual. Specifically, the reliabilities of the job characteristics measures are higher when the responses of five or more individuals who work on the same job are

averaged (Dotson and Hilbun, 1985:14).

4. Two concepts of the JCM are not measured by the JDS: knowledge and skill level, and employee work effectiveness (Dotson and Hilbun, 1985:15).

Despite these obvious problem areas with the survey instrument, the JDS is still highly respected by researchers as the most popular tool for the measurement of job characteristics (Fried and Ferris, 1987:288). The reliability of JDS measures was originally based on data that Hackman and Oldham obtained from 658 workers in 62 different jobs. Subsequently, the same authors conducted a more extensive survey of almost 7000 workers in 676 jobs and validated those measures of reliability. From these and other studies (Fried and Ferris, 1987), Hackman and Oldham concluded that "the JDS is a valid measure of the theory concepts in the Job Characteristics Model" (Dotson and Hilbun, 1985:15).

### Summary

This chapter reviewed selected theories and models which have a direct bearing on the increasingly important research areas of internal work motivation and job enrichment. Beginning with some of the classical schools of thought on worker motivation, this section also reviewed the works of Maslow, McGregor, and Herzberg. The issue of job redesign was examined as were Hackman and Oldham's conceptual framework (Job Characteristics Model) and measurement instrument (Job Diagnostic Survey).



### III. Methodology

#### Research Instrument Selection

To accomplish the broad research objectives and answer the investigative questions discussed in Chapter I, a method for measuring job characteristics levels in light of the issue of job redesign was deemed essential. For consistency and comparison purposes, it was also deemed essential to use the same conceptual framework and survey instrument that had been used in the previous navigator job characteristics research (Dotson and Hilbun, 1985). As noted in Chapter II of this research, the Job Characteristics Model (JCM) is probably the most investigated and reassessed job characteristics framework. Despite criticism of specific areas of the model, the overall theory has stood the scrutiny of over 200 research efforts and been found to be reasonably valid (Fried and Ferris, 1987:287).

The Job Diagnostic Survey (JDS) was specifically developed to address the variables contained in the JCM; and, as such, was logically chosen as the survey instrument for this research. Moreover, both the JCM and the JDS were used in the previously discussed navigator study, thereby fulfilling the requirement to use a common survey instrument and conceptual framework.

#### JDS Design Concept, Reliability, and Validity

The JDS is a data collection instrument that can be useful as a part of a multiple-method diagnosis. The particular version

of the JDS used for this research is a questionnaire consisting of 67 total items (53 attitudinal and 14 biographical). Attitudinal responses use a Likert scale of one to seven and four to ten. After scoring, all JDS concepts are expressed on seven point scales where 1 is low and 7 is high. Specific descriptions of each individual section of the survey instrument are detailed later in this chapter.

According to the authors, "The major intended uses of the JDS are (1) to diagnose existing jobs prior to work redesign, as one input in planning whether and how redesign should proceed, and (2) to evaluate the effects of work redesign - for example, to determine how much jobs have changed, to assess the effects of the changes on employee motivation and satisfaction, and to test for any spin-off effects of the job changes on employee growth need strength or satisfaction with the work context" (Hackman and Oldham, 1980:103).

In addition to having a solid conceptual framework, a survey instrument must also satisfy two key determinants of usefulness: reliability and validity. Reliability, simply stated, can be thought of as the amount of trust one can put into the results of a measurement instrument. As previously mentioned in Chapter II, the reliability of JDS measures was originally based on data that Hackman and Oldham obtained from 658 workers in 62 different jobs. Subsequently, the same authors conducted a more extensive survey of almost 7000 workers in 676 jobs and validated those measures of reliability.

From these and other studies using Cronbach's (1951) coefficient alpha (Fried and Ferris, 1987), Hackman and Oldham concluded that "the JDS is a valid measure of the theory concepts in the Job Characteristics Model" (Dotson and Hilbun, 1985:15).

The validity of a survey is determined by how well a survey instrument measures what it intends to measure. Hackman and Oldham's Job Characteristics Model and Job Diagnostic Survey have been reviewed and assessed by over 200 relevant studies in the past fifteen years. In the most comprehensive assessment of the model to date, Fried and Ferris applied meta-analytic procedures and a 90% credibility value (Pearlman, Schmidt, and Hunter, 1980) to a large portion of the data generated by those studies and concluded, "The evidence indicated that the available correlational results are reasonably valid in light of the issues examined" (Fried and Ferris, 1987:287).

#### JDS Measurement Items

Hackman and Oldham developed two slightly different versions of the JDS referred to as the "short and long" forms. The short form can be completed in approximately fifteen minutes as opposed to twenty five minutes for the long version. The two important distinctions between the versions are: 1) the short version does not measure the psychological states of the JCM; and, 2) a small number of other variables are determined by fewer items on the short version. The core job characteristics, however, are determined identically on both versions (Dotson and Hilbun,

1985:20-21). Hackman and Oldham emphasize that the short form is widely used in job characteristics research. They state: "Its properties, including item format, content and scale reliability have been well documented . . . and it has been shown to be a valid and reliable measure of the level of enrichment present in a job" (Hackman and Oldham, 1975:165).

The specific version of the Job Diagnostic Survey (Appendix A) used in this research is the short format which consists of a six part questionnaire composed of 53 attitudinal concepts and 14 biographical items. The short form was selected for use due to its ability to effectively measure all of the important constructs needed for this research at the least cost to the U.S. Air Force. The approving authority for this research effort, Air Force Military Personnel Center (AFMPC), emphasized this need for fiscal restraint and would not approve the use of the long version due to the associated higher costs.

After scoring, all JDS concepts are expressed on 7-point scales, where 1 is low and 7 is high. The overall motivating potential score (MPS) of a particular job, which was described in the previous chapter, can range from 1 to 343. According to the authors, "All JDS concepts except for growth satisfaction and the context satisfactions are measured using two different response formats in two different sections of the instrument. This, it is hoped, decreases somewhat the degree to which JDS results are method specific" (Hackman and Oldham, 1980:104).

Each section of the survey corresponds to a specific

construct contained in the JCM. Section one measures the five core job characteristics which serve as a foundation for the model's theoretical framework:

Job Characteristics (core dimensions)

1. Skill variety
2. Task identity
3. Task significance
4. Autonomy
5. Feedback from job (Hackman and Oldham, 1980:104-105).

Additionally, the JDS measures two supplementary concepts (Job characteristics) which are not specifically found in the model; but, nevertheless, provide an additional, quantifiable measure of an individual's motivation:

6. Feedback from agents: The degree to which the employee receives clear information about his/her performance from supervisors or from co-workers (Dotson and Hilbun, 1985:19).
7. Dealing with others: The degree to which the job requires employees to work closely with other people in carrying out the work activities (including dealing with other organization members and with external organizational clients (Dotson and Hilbun, 1985:19).

The second section of the JDS measures the affective outcomes associated with enriched work:

Affective Outcomes

1. General satisfaction
2. Internal work motivation
3. Growth satisfaction (Hackman and Oldham, 1980:305).

A measure of the fourth affective outcome, work effectiveness, is not presently measured by the JDS.

Section three is a comprehensive measurement of those

satisfactions associated with the job context itself. The JDS measures four different aspects of this moderating variable:

Context Satisfactions

1. Satisfaction with job security
2. Satisfaction with pay
3. Satisfaction with co-workers
4. Satisfaction with supervision (Hackman and Oldham, 1980:305).

The fourth section of the questionnaire determines the level of growth need strength (GNS) of the individual surveyed while the fifth section provides an overall measure of the three psychological states described in Chapter II; i.e., the Motivating Potential Score (MPS). Specifically, numerical scores for the five core dimensions are combined as follows:

$$\text{MPS} = \frac{\text{Skill variety} + \text{Task identity} + \text{Task significance}}{3} \times \text{Autonomy} \times \text{Job feedback}$$

(Hackman and Oldham, 1980:80-81).

The final portion of the survey contains biographic and demographic questions which, when answered, may provide the researcher with valuable insights into why a particular group may feel a certain way about a job. In this specific case, section six of the questionnaire was tailored to obtain necessary job-related information from the Air Force's navigator population. Additionally, an extra page with a request for subjective comments was added to the survey in order to provide a forum of expression for those individuals desiring one. These subjective comments were extremely useful in helping this author gain a broad perspective of current navigator concerns.

### Sample of Interest

Dotson and Hilbun, using the short form of the JDS, examined all sixteen variables measured by the survey and found a high degree of job dissatisfaction among Strategic Air Command (SAC) navigators. Specifically, navigators scored significantly lower than the norms on the core job characteristics of skill variety and autonomy, indicating a need for job redesign. Moreover, low scores were also obtained in the areas of growth satisfaction and job security. These negative feelings were deemed especially significant due to their possible dampening effects on any potential job enrichment effort of the navigator specialty (Dotson and Hilbun, 1985:61-62).

The findings of Dotson and Hilbun were based on large-sample hypothesis testing of means of 167 SAC navigators through the use of a Z-statistic. The sample was restricted to captains in the Air Force Specialty Code (AFSC) 15XX. (Dotson and Hilbun, 1985:21-34).

Table 2 is a side-by-side comparison of the national norms for technical workers as generated by Hackman, Oldham, and Stepina (1979) with the SAC navigator survey scores computed by Dotson and Hilbun (1985). Significant differences between the two groups have been indicated by either an "\*" (navigator lower) or a "\*\*\*" (navigator higher).

The purpose of the methodology used in this research was to satisfy the two broad objectives described in Chapter I : 1) Conduct an updated version of Dotson and Hilbun's work in order

TABLE 2

JOB DIAGNOSTIC SURVEY SCORE COMPARISON OF MEANS:  
NATIONAL NORMS (PROFESSIONAL WORKERS) VS. SAC NAVIGATORS

	<u>NORMS</u>	<u>(SAC) NAVIGATORS</u>	
<u>JOB CHARACTERISTICS</u>			
Skill variety	5.40	5.02	*
Task identity	5.10	5.09	
Task significance	5.60	5.63	
Autonomy	5.40	4.28	*
Feedback	5.10	5.33	**
Feedback from agents	4.20	4.66	**
Dealing with others	5.80	6.33	**
<u>AFFECTIVE OUTCOMES</u>			
General satisfaction	4.90	4.95	
Internal work motivation	5.80	5.80	
Growth satisfaction	5.10	4.69	*
<u>CONTEXT SATISFACTIONS</u>			
Job security	5.00	4.45	*
Pay	4.40	4.96	**
Co-workers	5.50	5.55	
Supervision	4.90	4.96	
<u>INDIVIDUAL GROWTH NEED STRENGTH</u>	5.60	5.86	**
<u>MOTIVATING POTENTIAL SCORE (MPS)</u>	154	119	*

(\* = statistically lower than the norm)

(\*\* = statistically higher than the norm)

Note: 1) The norms for technical workers were compiled by Hackman, Oldham, and Stepina (1979). They are based on the responses of 500 employees who work in non-managerial positions (Hackman and Oldham, 1979:23).

Note: 2) The SAC navigator means were determined by Dotson and Hilbun (1985). They are based on the responses of 167 navigators in the Strategic Air Command (SAC) (Dotson and Hilbun, 1985:37).



to examine the validity of their negative results regarding SAC navigators and its applicability to the entire USAF navigator population; and, 2) examine the effects of aircraft type and mission performed on the job characteristics levels of different categories of Air Force navigators.

In order to satisfy these objectives and answer the investigative questions found in Chapter I, an identification of the population to be surveyed was the essential first step. Active duty Air Force officers from first lieutenant through major who are currently performing navigator duties or duties directly related to the navigator career field (Duty Air Force Specialty Code (DAFSC) 15XX) were surveyed using the JDS. Also included in the survey population were those officers designated as flight test navigators (DAFSC 2875). Electronic warfare officers (DAFSC 1575 and 1595C), however, were excluded from this research effort despite the fact that they possess a navigator rating.

All of these decisions were made to limit the surveyed population to those individuals who are directly involved with the navigator career field at present, not those involved in some past or future endeavor. Specifically, the rank structure selected for this project sought to exclude those individuals who were still developing their attitudes about the job (second lieutenants) and those navigators involved more in a command capacity (lieutenant colonels and above) than in performing navigation/weapons duties.

The survey group was also limited by the stipulation that the Duty Air Force Specialty Code (DAFSC) be used in lieu of the Primary Air Force Specialty Code (PAFSC). Often, navigators with extensive flying experience will career broaden to a non-flying headquarters position or temporarily move to the acquisition/logistics community. These individuals will normally retain a navigator PAFSC while simultaneously possessing a DAFSC that reflects their present position. Thus, the decision to use the DAFSC meant that only those navigators currently working in a navigator or a closely related position could be selected for this research.

The final decision to include navigators of the test community in the survey, but not electronic warfare officers (EWO), was based on the fact that test navigators perform navigator-type duties while EWOs perform very specialized duties which are generally not associated with navigator/weapons activities.

Based on an inquiry of the USAF's personnel manpower database (ATLAS STAT SUMMARY inquiry # 15898), the population size was found to be 3814 officers. Random sampling was used to administer the JDS to the navigator population and a survey return rate of 40% was expected. This expected return rate was based on the 42% return rate achieved by Dotson and Hilbun (1985). In order to determine the maximum sample size from a known, finite population at a given confidence level, the following formula is generally accepted at the Air Force

Institute of Technology (AFIT):

$$n = \frac{N (z)^2 \times p(1 - p)}{(N - 1) (d)^2 + (z)^2 \times p(1 - p)}$$

where: n = sample size  
N = population size  
p = maximum sample size factor (.50)  
d = desired tolerance (.05)  
z = factor of assurance (1.96) for  
95% confidence level (HQ USAF/ACM, 1974:11-14).

A confidence/reliability level of "95%  $\pm$  5%" for survey results is the minimum one normally specified and desired by all professional surveying organizations and most kinds of organizational research. "Accordingly, a researcher conducting a survey will be 95% confident that the true population statistics lie somewhere within the interval  $\pm$  5 percentage points from the achieved sample statistics for each question in the survey" (HQ USAF/ACM, 1974:11-14).

Based on the information above and using a 95% confidence level, a sample size of 179 navigators was determined to be the minimum needed for this research. Moreover, the expected 40% response rate dictated that the actual sample size be no less than 448 officers. Due to economic constraints and a desire not to saturate Air Force personnel with surveys, however, the Air Force Military Personnel Center (AFMPC) limited all student research to a confidence level of 90%  $\pm$  10%. Recomputing the above formula with the factor of assurance (z) equalling 1.645, AFMPC authorized a sample size of 134 individuals as representative of 100% oversampling for the 67 minimum

respondents. The 134 navigators were then randomly selected by the ATLAS database system, which also provided name labels for mailing purposes. As surveys were received, means for the sixteen variables measured by the JDS were determined through the use of a scoring key (Appendix B) (Hackman, Oldham, and Stepina, 1979:169).

#### Data Collection and Analysis Plan

After determining the survey instrument to be used and the population to be surveyed, the next logical step in the construction of this methodology was to identify a process that would answer the investigative questions of Chapter I and, ultimately, the stated hypotheses. This process began with the division of the analysis plan into the two broad objectives of this research that have already been discussed. The first objective, conducting an updated version of Dotson and Hilbun's research effort Air Force-wide, was specifically dealt with through the first two investigative questions:

1. What are the motivation, job satisfaction, growth potential levels, and job characteristics levels of the average Air Force navigator as indicated by Hackman and Oldham's Job Diagnostic Survey (JDS) and the Job Characteristics Model (JCM) (Dotson and Hilbun, 1985:3)?
2. How do the above measures compare with the national norms as established by the JDS (Hackman and Oldham, 1974:23); and, how do these same measures compare to the results obtained by Dotson and Hilbun's 1985 research effort?

Like the previous navigator research of Dotson and Hilbun, this research used the diagnostic data of the JDS to obtain an

aggregate measure of the internal work motivation of the navigator career specialty. Means were calculated for each of the seven job characteristics, context satisfactions, motivating potential scores (MPS), and growth need strengths (GNS) in order to establish a quantitative profile of today's U.S. Air Force navigator. The important distinction between this study and the previous one, however, is the aggregate measurement of all Air Force navigators as opposed to only those navigators from a single operational command.

The second investigative question is a natural extension of the first because in order for any quantitative values to have meaning, they must be compared to some standard. After obtaining an average profile of all navigators, a comparison was made with the national norms for professional/technical workers. This was accomplished in order to replicate Dotson and Hilbun's work and validate their findings. Additionally, a second comparison was made between the average Air Force navigator profile, as established by this research, and the SAC navigator profile established by Dotson and Hilbun. Once again, the purpose of this step was to examine the consistency of previous findings and determine the applicability of those findings to the entire Air Force career field.

The second broad objective of this research effort, an examination of the effects of aircraft type and mission performed on the job characteristics levels of Air Force navigators, is reflected in the third investigative question:

3. How do factors such as aircraft type and the type of mission flown relate to higher or lower levels of job satisfaction (Dotson and Hilbun, 1985:3)?

This question was addressed by the division of the aggregate survey group into seven navigator sub-groups for the purpose of comparing and contrasting all sixteen JDS variables. These sub-groups were then attached to two, broad categories based on either aircraft type or the type of mission flown. Multiple comparison of means within each category was then conducted to determine statistically significant differences between the sub-groups. The hope was that those groups displaying significantly higher or lower scores than the others could be used to identify specific job satisfiers/dissatisfiers associated with the navigator career field.

Specific navigator categories and sub-groupings used in this section are as reflected below:

A) Aircraft Type

1. Multi-place: An aircraft normally having more than two crewmembers and more than two engines; often referred to as a "heavy" aircraft (Examples: B-1, B-52, C-130, KC-135, C-141).
2. Fighter-type: An aircraft normally having one or two crewmembers and no more than two engines (Examples: F-4, FB-111, F-15E, SR-71).

B) Type of Mission Performed

3. Tactical Airlift (Example: C-130)
4. Tanker/Strategic Airlift (Examples: KC-135, C-141, C-5)
5. Strategic Bomber (Examples: FB-111, B-52, B-1)

6. Tactical Fighter/Reconnaissance (Examples: F-4, F-111, F-15E, RF-4)

7. Test/Special Ops (Examples: C-135, MC-130, AC-130).

The rationale behind the division of the survey group was previously discussed in Chapter I but will be reviewed here. The author, based on previous experiences in the field, felt that Dotson and Hilbun's classification of all SAC navigators as a single entity did not address the possibility of varying attitudes within the job specialty. While probably correct as an aggregate measure of navigator job satisfaction in SAC, Dotson and Hilbun's study may have oversimplified the job attitudes of the navigator career field and may not have accurately reflected the feelings of many navigators in the Air Force.

The fourth and final investigative question addressed by this research was an attempt to link all of the other areas of concern with the issue of job enrichment:

4. Based upon analysis of the above measures, is there a need for redesign of the entire navigator career field or only selected segments of the population? If a need for redesign is documented, what is the potential for accomplishing a job redesign in the identified group (Dotson and Hilbun, 1985:3)?

In order to answer this question, a step-by-step approach based on a series of questions developed by Hackman and Oldham was used (Hackman and Oldham, 1980:109). First, the need for redesign was assessed by examining the affective outcomes portion of the JDS. If scores for the affective outcomes were found to be significantly above the norms, then it was concluded that observed problems within the career field probably have "little

to do with the fit between the people and their work, and work redesign may not be appropriate" (Hackman and Oldham, 1980:111). Conversely, low scores on these measures signified a possible need for enrichment, but other measures had to first be examined (Dotson and Hilbun, 1985:25).

Second, the motivating potential score (MPS) of the job was determined from the JDS because "Work redesign is an appropriate change strategy only if there is reason to believe that observed problems may have their roots in the motivational properties of the work itself" (Hackman and Oldham, 1980:111). A low MPS in conjunction with some of the potential problems already discussed would lead one to conclude that the work itself could be the problem. If the MPS was found to be high, however, "then it would be advisable to look to other aspects of the work situation (such as supervision, compensation, or co-worker relations) as possible causes of the observed difficulties" (Hackman and Oldham, 1980:111).

Third, the seven core characteristics of each navigator group were examined in order to determine what aspects of the job most needed improvement. This portion of the analysis highlighted those satisfiers/dissatisfiers associated directly with the job and identified those job dimensions "that were low in value and hence would possibly be prime targets for change" (Hackman and Oldham, 1980:115).

After assessing the need for the redesign of the navigator career field, the issue of the feasibility of such an effort was



then examined. First, employee readiness for change was ascertained by the growth need strength (GNS) measure from the JDS. A low GNS was not necessarily indicative of employee resistance to job enrichment due to the numerous mitigating circumstances that could affect an individual's feelings about the job. In order to obtain an accurate appraisal of navigator attitudes toward job redesign, it was necessary to assess GNS in conjunction with all of the other measurable items of the JDS (Hackman and Oldham, 1980:118)

The second part of the feasibility issue, institutional receptiveness to needed changes, was also the last part of the method used to determine the potential for job redesign in any/all of the navigator groupings. Hackman and Oldham identify three properties that must be considered in order to assess an organization's receptiveness to job enrichment:

1. the technological system
2. the personnel system
3. the control system (Hackman and Oldham, 1980:121).

Although these properties are not measured by the JDS, they should, nevertheless, be thoroughly understood and considered before attempting any job enrichment effort. Hackman and Oldham describe a phenomenon that is pervasive in work redesign projects called the "small change" effect. The "small change" effect occurs when numerous small compromises are made from the "ideal" work design to minimize the disruptiveness and cost of the changes. "The net effect, in many cases, is a project that

meddles with the work rather than redesigns it. The changes are safe, feasible, inexpensive - and ineffectual" (Hackman and Oldham, 1980:121).

How, then, does one differentiate between those organizations where substantial work redesign can take place and those where only tinkering (small changes) will occur? Hackman and Oldham suggest that an examination of the three properties enumerated above are the key (Hackman and Oldham, 1980:121).

The first property considered, the technological system, can constrain the feasibility of work redesign by simply limiting the number of jobs than can be enriched. As more and more jobs are made easier by technology, meaningful amounts of autonomy and employee discretion are removed. The end result of this technology explosion is that the enrichment of certain types of work is often unattainable unless the "technology itself is changed to be compatible with the characteristics of enriched work" (Hackman and Oldham, 1980:122-123).

The personnel system of an organization may also be an obstacle to any potential redesign efforts. "While explicit and detailed job descriptions can be helpful in the smooth operation of many personnel functions, they can also constrain the feasibility of work redesign" (Hackman and Oldham, 1980:123). Hackman and Oldham further suggest that sufficient slack should be available in existing job descriptions and personnel practices or any work enrichment effort risks falling victim to the "small change" effect (Hackman and Oldham, 1980:124).

Finally, organizational control systems can also provide an obstacle to job redesign by restricting autonomy at work. Hackman and Oldham define a control system as "any method designed to control and influence employee behavior in an impersonal, impartial, and automatic fashion" (Hackman and Oldham, 1980:124-125). Examples of common control systems are budgets, cost accounting systems, quality control reports, and attendance measuring devices. Job redesign often requires changes to be effected in many of these systems and is frequently met with much resistance by those having a stake in the preservation of those controls (Dotson and Hilbun, 1985:30).

This research utilized the three properties discussed above in order to assess the feasibility of job redesign in the identified navigator sub-groups. Because the JDS does not measure these variables, this issue was analyzed by an in-depth examination of subjective comments provided by the respondents. Additional support was provided by the author's nine years of operational experience in two different weapons systems.

### Research Test

Statistix II, a microcomputer software package installed on a Commodore Colt personal computer, was used to analyze the data. Using Statistix, both T-tests and Tukey's method for the multiple comparison of means were conducted to answer the investigative questions detailed earlier in this chapter. All testing was performed at the significance or rejection probability level of

.10 (10%; two-tailed) to reflect the 90% confidence level established by the sample size.

T-tests were used in this research to compare the JDS means obtained by Dotson and Hilbun with those aggregate navigator measures obtained by this study. Additionally, T-tests were also conducted in comparing the normative means of professional/technical workers with the same aggregate data determined by this research. This test method was chosen for these particular comparisons because "if one is interested in a single comparison of two means, the most powerful procedure is the T-test" (NH Analytical Software, 1987:5.24). Moreover, the normative means of Hackman and Oldham and the data of Dotson and Hilbun do not contain the individual observations needed to include them in the multiple comparison test.

Tukey's method for multiple means comparisons was used to test the two navigator categories (Aircraft type, Type of mission) and their respective sub-groups for differences in job characteristics, thereby highlighting those satisfiers/dissatisfiers which are significant. Tukey's method was chosen for these tests because it is generally accepted as one of the more useful pairwise comparison procedures and does not require a significant overall F-test (Ott, 1988:446-447). Moreover, Tukey's controls the experimentwise error rate yet still retains good power to detect significant differences among the means (NH Analytical Software, 1987:5.25).

### Test Assumptions

Three assumptions are required when using both the T-test and a multiple comparison procedure. First, the groups being compared must be independent of one another. Second, the population variances of all groups must be approximately equal. When this assumption could not be assured, a separate-variance T-test was used to test the means. This test is more conservative in declaring significant differences between means, but is also considered to be "somewhat more reliable" than the pooled variance T-test (Ott, 1988:174-179). Finally, the samples must be drawn from normal populations. The Central Limit Theorem (CLT) allows this assumption to be made for modest-sized samples where the total number of observations is at least thirty (Ott, 1988:174). This requirement for a modest-sized sample was fulfilled and the CLT was found to apply to this research.

### Summary

This chapter detailed the methodology used to accomplish the broad objectives of this research and answer the investigative questions posed in Chapter I. Areas discussed in this chapter were: research instrument selection, the design concept of the Job Diagnostic Survey (JDS), the validity and reliability of the JDS, JDS measurement items, the sample of interest, the data collection and analysis plan, specific research tests used, and assumptions necessary to use the tests.

#### IV. Data Analysis and Findings

##### Survey Response

The test results of the Job Diagnostic Survey (JDS) administered to 134 Air Force navigators was predicated on a minimum response rate of 50%, or 67 surveys. Of the 134 surveys authorized for mailing by the approving authority, 74 (55.22%) were returned for scoring. All surveys were scored as previously described in Chapter III using the JDS scoring key (Appendix B).

##### Analysis and Findings

In keeping with the overall objectives of the research methodology described in Chapter III, accumulated data was organized and analyzed in light of the four investigative questions discussed in the first chapter.

##### Investigative Question 1:

1. What are the motivation, job satisfaction, growth potential levels, and job characteristics levels of the average Air Force navigator as indicated by Hackman and Oldham's Job Diagnostic Survey (JDS) and the Job Characteristics Model (JCM) (Dotson and Hilbun, 1985:3)?

This first question was answered by organizing the needed data into a concise, usable format. Table 3 contains the computed means and standard deviations for the survey group and represents all Air Force navigators at a 90% confidence level. In essence, one can be 90% confident that the true population statistics are within  $\pm 10$  percentage points of those computed.

TABLE 3  
JOB DIAGNOSTIC SURVEY SCORES FOR USAF  
NAVIGATORS

	(USAF) <u>NAVIGATORS</u>	
<u>JOB CHARACTERISTICS</u>	MEAN	STD DEV
Skill variety	5.23	1.12
Task identity	4.97	1.18
Task significance	5.58	1.27
Autonomy	4.59	1.23
Feedback	5.29	1.03
Feedback from agents	4.60	1.42
Dealing with others	6.14	0.83
 <u>AFFECTIVE OUTCOMES</u>		
General satisfaction	5.13	1.43
Internal work motivation	5.78	0.97
Growth satisfaction	4.78	1.34
 <u>CONTEXT SATISFACTIONS</u>		
Job security	4.21	1.58
Pay	3.98	1.66
Co-workers	5.36	1.02
Supervision	4.75	1.30
 <u>INDIVIDUAL GROWTH NEED STRENGTH</u>		
	5.90	0.84
 <u>MOTIVATING POTENTIAL SCORE (MPS)</u>		
	135.6	61.29

Note: 1) The USAF navigator means are based on the responses of 74 navigators in all flying commands.

## Investigative Question 2:

2. How do the above measures compare with the national norms as established by the JDS (Hackman and Oldham, 1974:23); and, How do these same measures compare to the results obtained by Dotson and Hilbun's 1985 research effort?

In order to answer the first part of question 2, the results of Table 3 were compared with the national norms for professional workers as established by Hackman and Oldham. As previously mentioned, these norms were generated by the compilation of scores from 6930 individuals working on 375 different jobs in 56 organizations (Hackman and Oldham, 1979:12). Table 4 illustrates this comparison which is a critical first step in deciding whether or not a particular job (career field) is in need of enrichment or redesign.

Although four of the seven core job characteristics received scores lower than the national average, only one was determined to be statistically below the norm: autonomy. Hypothesis testing of means and the use of the T-statistic confirmed this finding. The apparent differences of the characteristics of skill variety, task identity, and task significance from the national averages, however, were not found to be statistically significant. Thus, those three variables were considered to be essentially equal to the national norms.

The remaining two core characteristics, feedback from agents and dealing with others, were found to be statistically higher than the national averages and will be examined thoroughly later in this section.



The comparison of the three affective outcomes with the national averages was also accomplished and illustrated in Table 4. The only affective outcome found to be statistically below the norm was growth satisfaction. The two other measures in this category, internal work motivation and general satisfaction, were not statistically significant in relation to the national means.

Measurement of the four context satisfaction variables is also reflected in Table 4. Both job security and pay were found to be appreciably below (statistically significant) the national norms for professional/ technical workers. Despite being slightly less than the national norms, the two remaining context satisfactions (satisfaction with co-workers and supervisors) were found to be essentially the same as the norms (statistically insignificant).

The last two factors to be computed by the JDS and illustrated in Table 4 were: growth need strength (GNS) and motivating potential score (MPS). The GNS variable was determined to be statistically higher than the norm while the MPS variable was not found to be significantly different from the standard.

In order to avoid the trap of quantitative analysis or "number crunching" for its own sake, a qualitative analysis of the statistically significant variables was deemed essential to the analysis of the data. Specifically, the significance of a low or high rating on a particular variable of the JDS (relative to the national average) was determined.

TABLE 4

JOB DIAGNOSTIC SURVEY SCORE COMPARISON OF MEANS:  
NATIONAL NORMS (PROFESSIONAL WORKERS) VS. USAF NAVIGATORS

	<u>NORMS</u>	<u>(USAF) NAVIGATORS</u>	
<u>JOB CHARACTERISTICS</u>			
Skill variety	5.40	5.23	
Task identity	5.10	4.97	
Task significance	5.60	5.58	
Autonomy	5.40	4.59	*
Feedback	5.10	5.29	
Feedback from agents	4.20	4.60	**
Dealing with others	5.80	6.14	**
<u>AFFECTIVE OUTCOMES</u>			
General satisfaction	4.90	5.13	
Internal work motivation	5.80	5.78	
Growth satisfaction	5.10	4.78	*
<u>CONTEXT SATISFACTIONS</u>			
Job security	5.00	4.21	*
Pay	4.40	3.98	*
Co-workers	5.50	5.36	
Supervision	4.90	4.75	
<u>INDIVIDUAL GROWTH NEED STRENGTH</u>	5.60	5.90	**
<u>MOTIVATING POTENTIAL SCORE (MPS)</u>	154	135.6	

(\* = statistically lower than the norm)  
(\*\* = statistically higher than the norm)

Note: 1) The norms for technical workers were compiled by Hackman, Oldham, and Stepina (1979). They are based on the responses of 500 employees who work in non-managerial positions (Hackman and Oldham, 1979:23).

Note: 2) The USAF navigator means are based on the responses of 74 navigators in all flying commands.

Autonomy, the first problem area for the Air Force navigator, is defined as the degree to which a job provides substantial freedom and discretion to an individual in scheduling the work and determining the procedures to be used in completing it (Hackman and Oldham, 1980:79). Based on the author's numerous years of operational flying, a low score in autonomy might be expected. Rules, regulations, procedures, doctrine, publications, checklists-these are but a few of the "instruments of usurpation" that remove the navigator's ability to think for himself. The critical nature of almost all of the flying missions to potentially cause varying degrees of destruction, loss of life, and/or loss of government resources has been the main impetus toward the creation of these limiters of navigator autonomy. Additionally, numerous survey participants complained in the comments section of the JDS that the navigator is relegated to permanent second class status because flying regulations define the navigator role as one of support to the pilot. This institutionalization of the support role, the respondents claimed, keeps navigators from ever being aircraft commanders and, thus, does not permit them the opportunity to make their own decisions.

Growth satisfaction, the second navigator problem area, was previously described as one of the personal outcomes associated with the motivating potential of a job (Hackman and Oldham, 1980:89). Navigator comments on this particular item were instrumental in providing an understanding of the below average

scores. Of the 74 surveys received, 69 of them (93%) contained at least one negative comment about the career field. More importantly in terms of growth satisfaction, 60 of those 69 respondents felt that career progression, growth, and increased responsibility within the navigator career field are severely limited by a lack of mid and upper-level positions available to navigators. The general perception among those surveyed was that pilots receive a disproportionate share of the "good" jobs in operations simply because of their rating. Five survey responses pointed to the results of the latest lieutenant colonel promotion board (1989), where navigators finished substantially behind pilots and non-rated officers in the percentage of each group promoted, as evidence of an institutional bias against navigators. Consistent with this line of reasoning, those navigators also believe that the only way to obtain growth and increased responsibility is to seek opportunities outside of operational flying in rated supplement or staff positions. A comment by one of the survey participants with eleven years of flying experience was quite representative of the sample group on this issue:

"I wish the Air Force would treat their WSOs/Navs as officers first and specialized aircrews second. I am currently a flight commander in the F-111D, and I feel that career progression from this position on is going to be much harder for me than my pilot counterparts. In the air, we have different specialties and responsibilities; on the ground, we are all officers and should be treated equally."

The last two areas of concern, job security and pay, fall into the context satisfaction grouping. As previously discussed,

context satisfiers do not positively affect the outcomes of work motivation or job satisfaction. Rather, such variables are included in the conceptual framework of the model due to the mainly negative effect that they can have on job redesign efforts. The first of the two low scores, job security, appears to be a reflection of the continuing trend toward fewer and fewer navigators as older systems are retired and newer ones are brought on line. These newer systems are generally built in fewer numbers than the aircraft they replace (due mainly to cost), and/or have been designed without the need for a navigator. In support of this assessment, 45 of the 74 survey respondents (61% of the total) identified the probable elimination of the navigator career field in the near future as a major concern. Comments from those individuals assigned to aircraft systems designated for retirement, replacement, or a command change were the most pessimistic:

"The Air Force seems to be working toward elimination of the WSO (navigator) career. Opportunities beyond line aircrew are shrinking, as are the number of cockpit positions (F-4s retiring and cutback of F-15E)... I have a perception (growing) that there really isn't any need for a WSO beyond the mid-captain level. A single-seat mentality is definitely starting to prevail."

The second of the two negative context satisfactions, pay, generated the highest number of negative comments of any of the measured variables. Specifically, 64 of the 74 surveys received (86%) mentioned the pay issue as a major source of dissatisfaction among navigators. The main focus of these negative feelings, however, was not the adequacy of the

compensation received, but, rather, the perception of unfairness associated with the recently created pilot incentive bonus. This bonus has been described as an economic method of retaining qualified pilots in the Air Force at a time when the demand for their specialized skills by the airlines has continued to increase. Survey responses on this issue, however, revealed that navigators perceive the bonus as a flawed concept that has weakened crew integrity and reinforced the notion of the navigator as a "second class citizen."

As previously stated in this section, above average scores were obtained on three of the JDS factors: feedback from agents, dealing with others, and individual growth need strength. These positive ratings were more difficult to assess due to the lack of respondent comments on such variables; however, based on the author's experiences, they were not unexpected. Regardless of the command or type of aircraft, navigators are constantly being evaluated in the performance of their duties. The type of evaluation may vary from a formalized annual evaluation of the navigator's capabilities (which includes a formal debriefing) to a more informal training session where an instructor or fellow crewmember simply states, "good job." It must be noted here that feedback can be and often is negative in the operational flying world; nevertheless, the Job Characteristics Model (JCM) suggests that having feedback is better than not having feedback (Hackman and Oldham, 1980:104).

Dealing with others, the second of the three above average factors, is inherent to the operation of aircraft. Based on the author's operational experience, pilots, navigators and other specialized crewmembers must regularly coordinate with the other personnel on their aircraft if the mission is to be successfully and safely accomplished. The results obtained on this job characteristic were not unexpected.

The individual growth need strength (GNS) measure was the last variable to be found statistically higher than the national average. Such a high GNS score indicates a desire for growth or change within the specialty and is helpful in determining whether navigators would react favorably to any job enrichment efforts.

In order to answer the second part of question 2, the results of Table 3 (USAF navigator means) were compared with the means established by Dotson and Hilbun in their job characteristics study of Strategic Air Command (SAC) navigators. As previously mentioned, these results were based on the responses of 167 navigators in the Strategic Air Command (SAC) (Dotson and Hilbun, 1985:37). Table 5 illustrates this comparison which is significant in its attempt to validate the findings of the previous study and determine the applicability of those findings to the entire USAF navigator career field.

A statistical comparison of means was again conducted between the groups by the use of the T-statistic. Only two categories were found to be statistically different from one another and these two factors were the main focus of this part of

the analysis. Additionally, one other variable of interest was examined in light of the anomalies created by the cross-comparison of both navigator studies to the national norms.

Autonomy in the USAF navigator population was found to be significantly higher than the level found in the SAC population. Some possible reasons for this difference will be discussed later in this chapter when the aircraft and mission breakdowns are examined. Nevertheless, based on the author's experiences in SAC, one can speculate that SAC's role as a mainstay of the country's nuclear deterrent force makes it a unique entity in some respects. Associated with this strategic role is the strict adherence to procedures and regulations that SAC aircrews have been both admired and admonished for over the years. Previous discussions of autonomy pointed out how such methodical methods have removed much of a navigator's ability to make his/her own decisions without first consulting the applicable directives.

Despite the differences in autonomy noted in these two studies, both the SAC mean and the Air Force mean were still observed to be significantly below the national average for professional workers as evidenced by Tables 2 and 4. Nevertheless, statistical testing confirmed a higher level of navigator autonomy in the Air Force population than Dotson and Hilbun observed in their study.

Pay satisfaction, the second area with contrasting means, was observed to be statistically lower in the Air Force population than in the SAC population. An important point to



note here is that Dotson and Hilbun found the SAC mean (Table 3) to be much above the national norm on pay satisfaction in 1985. In essence, navigators believed they were being compensated fairly for their efforts. This study, however, observed Air Force navigators to be statistically lower than the national norms and the findings of Dotson and Hilbun on the pay variable. This dramatic swing in attitude can be directly attributed to the pilot incentive bonus discussed earlier in this section. A total of 64 individuals (out of 74) mentioned this issue in the optional comments section of the survey as negatively affecting their overall job satisfaction. Many of the comments conveyed a sense of anger and frustration among navigators about what is perceived to be a basically unfair decision.

The last variable examined in this comparison of the two survey groups was the motivating potential score (MPS). As a single index that reflects the overall potential of a job to enhance internal work motivation, the MPS was examined closely in all comparisons conducted for this research. Although the difference between SAC navigators and Air Force navigators was not found to be significant, a closer observation of this statistic illustrated an important consideration. The SAC MPS score determined by Dotson and Hilbun was found to be significantly below the national average for that variable (Table 2). Because the MPS provides a consolidated score of all of the motivating properties of a job, this low score (along with other factors) indicated that the SAC navigator career field was in

need of a job redesign effort (Dotson and Hilbun, 1985:61). The aggregate Air Force average for MPS, however, was found to be statistically equal to the national norm (Table 5). This result seemed to indicate that a redesign effort of the Air Force navigator career field might not be necessary; i.e., the findings of Dotson and Hilbun were not applicable to the entire Air Force navigator population. Thus, although the two navigator MPS scores were close enough to each other to be considered statistically equal, the Air Force MPS was arithmetically larger. This difference allowed the Air Force figure to be equal (statistically) to both the norms and Dotson and Hilbun's MPS.

Investigative Question 3:

3. How do factors such as aircraft type and the type of mission flown relate to higher or lower levels of job satisfaction (Dotson and Hilbun, 1985:3)?

The third investigative question was answered as described in Chapter III. The first part of this question called for the division of all survey respondents into two independent subgroups (based on the type of aircraft flown). The groups were described in the methodology portion of this paper and are reviewed here:

A) Aircraft Type

1. Multi-place: An aircraft normally having more than two crewmembers and more than two engines; often referred to as a "heavy" aircraft (Examples: B-1, B-52, C-130, KC-135, C-141).
2. Fighter-type: An aircraft normally having one or two crewmembers and no more than two engines (Examples: F-4, FB-111, F-15E, SR-71).

TABLE 5

JOB DIAGNOSTIC SURVEY SCORE COMPARISON OF MEANS:  
SAC NAVIGATORS (1985) VS. USAF NAVIGATORS

	(SAC) <u>NAVIGATORS</u>	(USAF) <u>NAVIGATORS</u>
<u>JOB CHARACTERISTICS</u>		
Skill variety	5.02	5.23
Task identity	5.09	4.97
Task significance	5.63	5.58
Autonomy	4.28	4.59 **
Feedback	5.33	5.29
Feedback from agents	4.66	4.60
Dealing with others	6.33	6.14
<u>AFFECTIVE OUTCOMES</u>		
General satisfaction	4.95	5.13
Internal work motivation	5.80	5.78
Growth satisfaction	4.69	4.78
<u>CONTEXT SATISFACTIONS</u>		
Job security	4.45	4.21
Pay	4.96	3.98 *
Co-workers	5.55	5.36
Supervision	4.96	4.75
<u>INDIVIDUAL GROWTH NEED STRENGTH</u>	5.86	5.90
<u>MOTIVATING POTENTIAL SCORE (MPS)</u>	119	135.6

(\* = statistically lower than the SAC mean)  
(\*\* = statistically higher than the SAC mean)

Note: 1) The SAC navigator means were determined by Dotson and Hilbun (1985). They are based on the responses of 167 navigators in the Strategic Air Command (SAC) (Dotson and Hilbun, 1985:37).

Note: 2) The USAF navigator means are based on the responses of 74 navigators in all flying commands.

Table 6 illustrates the computed means for both aircraft types. Statistically significant differences between the two groups were determined by Tukey's pairwise comparison of means and are included in the displayed data. Of the 74 survey respondents, 44 were classified as multi-place navigators and 30 were designated as fighter-type navigators (WSOs). Only two significant differences were found between the two groups and both factors were core job characteristics.

Fighter-type navigators scored significantly higher on both skill variety and task significance than did multi-place navigators. Based on the author's experiences in both types of aircraft (B-52, FB-111), these results were not surprising. Skill variety, the degree to which a job requires a variety of activities, skills, and talents to complete it, is necessarily higher in a fighter-type aircraft that has fewer people to complete its mission (Hackman and Oldham, 1980:78). The navigator in such an aircraft often acts as the co-pilot, electronic warfare officer, and weapons officer while simultaneously completing his basic navigation duties. Hence, certain Air Force Commands and the US Navy no longer use the title "Navigator" when referring to the equivalent position within their organizations.

Task significance, the second variable of interest in this comparison, is associated with how much impact a particular job can have on the lives of others (Hackman and Oldham, 1980:79). Generally speaking, fighter-type navigators feel their jobs to be

significant because they know if they do not accomplish their duties properly (in training or wartime), loss of life and/or the destruction of the aircraft can occur. The same statement can be made about many multi-place navigators, but these individuals are often mutually supported by other crewmembers who are able to accomplish some of the same functions (especially in peacetime), thereby reducing the level of the job's significance. This lack of indispensability often leads to feelings of insignificance on the part of the navigator in terms of his/her overall contribution to the success of the mission. Comments on 20 of the 44 (46%) multi-place surveys reflected this attitude and are typified by this statement by a C-141 navigator:

"Often times, the significance of a navigator's efforts are overlooked or minimized at best. More often than not, the only time you see a navigator's name in lights is when something went wrong with a mission... Some, not all, pilots have the feeling that they could just as well, if not better, than the navigator could ever do and, therefore, the navigator is a "third wheel" in their minds. The only time they want to hear from you is when something has gone wrong; then they want to know how you are going to fix it. In such cases, if there is any feedback, it is usually negative. Makes it kind of tough to feel significant."

Although a comparison of all of the other variables found no significant differences between the two navigator sub-groups, several additional observations were made concerning the data. Arithmetically, fighter-type navigators obtained higher scores on five of the seven core job characteristics, all three of the affective outcomes, individual growth need strength (GNS), and the motivating potential score (MPS). In terms of the original hypothesis, however, autonomy was not found to be significantly

different between the two groups. Surprisingly, being assigned to a fighter with only two people working together did not promote the expected higher levels of autonomy. This result can probably be attributed to the strength of the various controlling mechanisms (checklists, manuals, procedures) that were previously discussed.

Multi-place navigators generated higher arithmetic scores (none significant) in two of the seven job characteristics and all four of the context satisfactions (pay, job security, co-workers, supervisors). The means for co-workers and supervisors, however, were so close between the groups that a rounding error on either of them could have resulted in the fighter group having the higher score. The significance of these additional observations in conjunction with the two significant job characteristics is that higher levels of internal work motivation seem to be associated with the fighter group as opposed to the multi-place group.

The second part of investigative question 3 addressed the affects of the type of mission performed on the job characteristics levels of Air Force navigators. All 74 participants were again grouped into independent sub-groups for analysis. The five groups were described in the methodology portion of this paper and are reviewed here:

B) Type of Mission Performed

1. Tactical Airlift (Example: C-130)
2. Tanker/Strategic Airlift (Examples: KC-135, C-141, C-5)

TABLE 6

JOB DIAGNOSTIC SURVEY SCORE COMPARISON OF MEANS:  
MULTI-PLACE NAVIGATORS VS. FIGHTER-TYPE NAVIGATORS

	<u>MULTI-PLACE NAVIGATORS</u>	<u>FIGHTER-TYPE NAVIGATORS</u>	
<u>JOB CHARACTERISTICS</u>			
Skill variety	4.95	5.64	**
Task identity	5.19	4.65	
Task significance	5.29	6.01	**
Autonomy	4.54	4.66	
Feedback	5.28	5.32	
Feedback from agents	4.48	4.78	
Dealing with others	6.22	6.03	
<u>AFFECTIVE OUTCOMES</u>			
General satisfaction	4.98	5.36	
Internal work motivation	5.68	5.94	
Growth satisfaction	4.64	4.20	
<u>CONTEXT SATISFACTIONS</u>			
Job security	4.25	4.15	
Pay	4.13	3.77	
Co-workers	5.38	5.34	
Supervision	4.75	4.74	
<u>INDIVIDUAL GROWTH NEED STRENGTH</u>	5.85	5.98	
<u>MOTIVATING POTENTIAL SCORE (MPS)</u>	131.9	140.9	

(\*\* = statistically higher than the Multi-place mean)

Note: 1) The USAF navigator means are based on the responses of 74 navigators in all flying commands.

Note: 2) Multi-place navigator means are based on the responses of 44 navigators in all flying commands; fighter-type navigator means are based on 30 respondents.

3. Strategic Bomber (Examples: FB-111, B-52, B-1)
4. Tactical Fighter/Reconnaissance (Examples: F-4, F-111, F-15E, RF-4)
5. Test/Special Ops (Examples: C-135, MC-130, AC-130).

Table 7 illustrates the computed means for the five mission-differentiated navigator groups. Statistically significant differences among the sub-groups were determined by Tukey's pairwise multiple comparison of means and are included in the displayed data. Of the 74 survey respondents, 8 were categorized with group 1; 16 with group 2; 28 with group 3; 17 with group 4; and 5 with group 5. Three variables in this comparison were found to have differences among the means, with two of the three being core job characteristics. The third variable, pay satisfaction, has been discussed at length in previous analyses and will be examined again in this section.

Task identity, the first significant job characteristic, is defined as the degree to which a job requires completion of a "whole" and identifiable piece of work (Hackman and Oldham, 1980:78). The tactical airlift group (Group 1) was found to possess a significantly higher level of this core variable than either the fighter group (Group 4) or the test/special ops group (Group 5). Because the author had very little experience with the Military Airlift Command and the tactical airlift mission, an interview was conducted with a resident C-130 instructor navigator to determine why such feelings exist (Johnson, 1989). Additionally, valuable information was obtained from the optional



comments section of the survey responses. Based on an analysis of these sources, it was determined that the C-130 mission is quite demanding and diverse. Primarily used to transport troops and supplies as close to the front lines as possible, the C-130 must be able to operate out of rudimentary airfields with very few external navigational aids. Additionally, the C-130 aircraft is not a glamorous jet fighter bristling with new technology. Rather, it is a propeller driven aircraft with little of the modern avionics equipment that can be found on many of the Air Force's weapons systems. These limitations make the navigator an extremely important part of the crew because his basic navigation skills are necessary to complete most missions. Moreover, the navigator generally does most of the mission planning without the benefit of a computer flight plan and is able to see the mission develop from the "beginning to end with a visible outcome" (Hackman and Oldham, 1980:78).

The fighter and test groups were assessed to be statistically lower than the tactical airlift navigators on this variable despite the fact that neither of these groups were found to be statistically below the national norm (Table 2). Reasons for their relatively low scores (compared to tactical airlift) are probably based more on the C-130 navigator's high level of identification with his task than with actual problems existing in the fighter or test groups.

Task significance, the second variable to be examined, was previously determined to be higher (statistically) among fighter-

type navigators than multi-place navigators. This comparison found a significantly higher level of task significance among strategic bomber navigators (Group 3) than among tanker/strategic airlift navigators (Group 2). The tanker/strategic airlift group was also found to be the only group significantly below the national norm (Table 2). Based on the author's previous experiences, strategic bomber navigators generally feel that their mission of strategic deterrence is extremely important and that they have a major part in accomplishing it. Additionally, the low-level training missions (often flown at night) are quite complex and require the specialized terrain avoidance/terrain following skills and weapons knowledge that only the navigators possess. These findings about this group are important because the bomber category is composed of both multi-place (B-1, B-52) and fighter aircraft (FB-111). Thus, the type of mission a navigator flies appears to be more important than the type of aircraft in determining the significance of the work performed.

The tanker/strategic airlift navigators, on the other hand, generally feel that their missions are important, but that their contributions to that mission are either limited or insignificant. Numerous comments by both KC-135 (tanker) and C-141 (strategic airlift) navigators mentioned the negative effects that technology is having on the significance of their efforts. The following quote is typical:

"The INSS (inertial navigation systems) are the primary navigation system. I am only a backup (ask the pilots I fly with). I'm not bitter about being replaced by automation... The missions are often boring and repetitive."

The last variable considered significant in this analysis was pay satisfaction. Tactical airlift navigators (Group 1) were found to be statistically more satisfied with their pay than either tactical fighter navigators (Group 4) or strategic bomber navigators (Group 3). The low scores were directly attributed to the issue of the pilot incentive bonus, which was discussed earlier in this chapter. Before trying to ascertain why such a difference exists, it is important to note that every group except the tactical airlift group was below the national norm for pay. In light of these consistent scores, the tactical airlift scores on this variable were somewhat puzzling and not easily explained. Some of the optional comments made by C-130 navigators were helpful in gaining insight into the "why" of their feelings on this issue. As previously discussed in this chapter, C-130 navigators highly identify with their mission and the role they play in it. A lack of modern navigation equipment and the obscure places to which they sometimes fly make the navigator on the C-130 one of the last true "navigators" in the Air Force. Additionally, the tactical airlift group scored higher than any of the other four groups on job security despite the fact that these comparisons were not statistically significant and still arithmetically below the national norm (Table 2). Add to these observations the belief (by the navigators) that the C-130 will be around without any major modifications for the foreseeable future, and one can speculate that C-130 navigators feel more comfortable in their positions

and generally more satisfied than navigators in most other groups. Thus, they may dislike the overall concept of the pilot bonus, but are able to accept the Air Force's economic argument for retaining pilots. One comment by a C-130 navigator with three years experience was representative of this attitude:

"Some animosity is felt towards the special treatment and pay incentives paid to pilots at the expense of navigators, but I understand the dilemma the Air Force faces with pilot retention."

Strategic bomber and tactical fighter navigators were found to be extremely sensitive to the pilot bonus and, as such, dissatisfied with the pay received for their efforts. In retrospect, both of these groups obtained relatively high scores on task significance, indicating that these individuals feel their jobs to be important. Because they perceive their roles as significant and essentially equal to that of the pilot, these fighter and bomber navigators seemed to react the most negatively to the pilot incentive bonus. Optional comments on this issue ranged from completely emotional responses to rational economic arguments that attempted to show that the policy will be ineffective. Opposition to the bonus, however, was almost unanimous within these groups (41 opposed; 3 no comment; 1 not opposed). Many comments referred to the bonus as a "cockpit splitter" and the pilots receiving it as "bonus babies." Additional comments brought up the subject of potential navigator separations from the Air Force as a result of the policy:

"Incentive pay (pilots) -vs- (navigators) has been a point of focus among many WSOs (navigators). Numerous instances

have linked this further separation between aircrews as the last straw before leaving active duty."

The final portion of the investigative question 3 analysis focused on those variables within the five sub-groups that were significantly lower than the norms in the overall aggregate analysis. These variables were reinvestigated to determine if any particular sub-groups scored higher than the aggregate measures and/or at least equal to the national norms described in Table 2. The first variable, autonomy, has been found to be consistently low throughout the comparisons of this study. The aggregate measure of autonomy for all Air Force navigators was statistically lower than the norm, and both means from the aircraft comparisons were also arithmetically smaller than the norm (Table 6). The test/special operations group (Group 5) had the highest autonomy score (arithmetically) of all of the means examined, but was still slightly below the national norm. This relatively high score is not surprising since this group is very small, and quite different from most normal line navigators. In the case of the test navigators, there are only 22 of them in the entire Air Force and they are granted much discretion and decision making ability in the development of new aircraft systems. Special ops navigators are also a small group and have more autonomy than the average navigator because their mission calls for much flexibility and less emphasis on rigid procedures and rules. Once again, however, the data obtained for all groups did not support the original hypothesis that fighter navigators would possess more autonomy.

The tanker/strategic airlift group scored the lowest overall on this measure of autonomy due to the increasing effectiveness of technology (navigation systems). Efficient computer systems have turned what was at one time a very challenging job into a somewhat boring, repetitive task that has removed much of the navigator's decision-making ability.

The second variable to be assessed in light of the five mission-differentiated categories was growth satisfaction. Once again, all comparisons of this variable with the national norms up until this point have yielded means either statistically below the norm or arithmetically lower than the norm. In terms of the five sub-groups, however, the test/special ops group was assessed to be slightly higher than the national average (arithmetically) and higher than any other navigator group. This rating seems to reflect the relatively high potential of this group for growth and increased responsibility compared to the other navigator groups. Specific information was not provided in the optional comments section to explain the specifics of why this group perceives its growth potential as higher than most other groups in the career field. In fact, most of the comments expressed by this group reflected the same concerns of job security, perceived pay inequities, and general feelings of not being able to compete equally against pilots for command positions and promotions. Some of the concerns voiced by this group, however, were quite unique to the test world. One concern expressed by a fighter test navigator, who is qualified in two aircraft and regularly

flies them both, is that the work is less challenging than he had been used to in the operational environment. One of his immediate goals is to be reassigned to a new, more challenging test program to facilitate his needs. Based on the author's experience, such concerns are probably difficult for most line navigators to identify with. For instance, the great majority of navigators remain in a single aircraft for their entire careers and do not routinely become dual-qualified or involved with the test world. These types of differences do not specifically explain why this group scored relatively high on growth satisfaction in relation to the other groups. Such differences, however, do illustrate the uniqueness of the test/special ops environment and provide some insight into the possible career path of a test navigator.

The group with the lowest score on growth satisfaction was the tanker/strategic airlift group. Based on previous discussions in this chapter, most navigators in this group find little challenge in their work and even less potential for growth in the job. Many comments professed the need for navigators in this group to move out of the cockpit and into other non-flying duties if promotions and growth are desired. Like many of the other groups, the tanker/strategic airlift group has an overriding concern that the system does not recognize their potential for increased responsibility due to the type of wings they wear. Ten comments criticized the new Officer Evaluation System (OES) as a way of promoting more pilots in order to keep

them from going to the airlines. The concerns expressed here, however, should not be viewed as unique to this group. Rather, they are common reflections of what the other navigator groups feel, but at a higher level of intensity.

Although no statistical differences in job security were found among the mission-differentiated groups, all groups, nevertheless, scored arithmetically below the national norms for this variable. These scores reflect a genuine concern that the navigator career field will eventually disappear. As evidence of this phenomenon, navigators in all groups point to the continuing trend toward fewer and fewer navigators as older systems are retired and newer ones are brought on line. These newer systems are generally built in fewer numbers than the aircraft they replace (due mainly to cost), and/or have been designed without the need for a navigator. Specific examples mentioned in the comments section were:

Current Aircraft	Replacement Aircraft
F-4 (1 navigator)	F-16 (no navigator) F-15 (1 navigator, less aircraft)
B-52 (2 navigators)	B-1 (1 navigator, less aircraft) B-2 (no navigator)
F111, FB-111 (1 navigator)	No replacement

Additional aircraft such as the C-5 and C-141 have a limited role for navigators and this is not anticipated to increase.

One note of interest that was described in Chapter I as a potential limitation of this study was the effect that the proposed transfer of a particular aircraft might have on the job



security variable within the affected group. A good example of such change is the current proposal to transfer SAC's FB-111 fighter-bomber permanently to the tactical air forces at an undecided location and date. This decision, as evidenced by the lowest job security mean of all groups (Table 7, Group 3), has caused consternation among this group of navigators because the future of these officers has yet to be determined. Based on comments made by FB-111 navigators, job security in the strategic bomber category will probably continue to be artificially low until some concrete personnel decisions are made and relayed to the crews.

The final variable to be examined in this comparison was the motivating potential score (MPS). As a consolidated measure of all of the job characteristics, the MPS is an extremely useful tool for determining the overall potential of a job to internally motivate workers. In the aggregate study of Air Force navigators and the comparison between aircraft types, no MPS score was found to be statistically less than the national norm for that variable. Dotson and Hilbun's study, however, found the MPS navigator mean to be less than the national average (Table 3), and this low score greatly influenced their decision to call for a redesign of the navigator career field. In the present comparison of mission-differentiated MPS means, the tanker/strategic airlift group generated the only score below the mean of Dotson and Hilbun's study (Table 2 and Table 7). This result was expected because the MPS is a multiplicative index of

TABLE 7

JOB DIAGNOSTIC SURVEY SCORE COMPARISON OF MEANS:  
MISSION-DIFFERENTIATED CATEGORIES

<u>JOB CHARACTERISTICS</u>	1	2	3	4	5
Skill variety	5.37	4.99	5.43	4.94	5.60
* Task identity	5.75	5.11	5.13	4.39	4.40
* Task significance	5.50	4.83	5.90	5.73	5.80
Autonomy	5.00	4.15	4.50	4.76	5.20
Feedback	5.37	4.98	5.56	5.23	4.90
Feedback from agents	4.87	4.25	5.06	4.63	4.20
Dealing with others	5.92	6.29	6.39	5.65	6.33
<u>AFFECTIVE OUTCOMES</u>					
General satisfaction	5.08	4.90	5.28	5.18	4.93
Internal work motivation	5.94	5.78	5.71	5.96	5.40
Growth satisfaction	5.03	4.35	4.93	4.71	5.20
<u>CONTEXT SATISFACTIONS</u>					
Job security	4.75	4.38	3.84	4.38	4.30
* Pay	5.56	4.09	3.46	3.91	4.20
Co-workers	5.25	5.44	5.29	5.41	5.60
Supervision	5.04	4.77	4.86	4.40	4.73
<u>INDIVIDUAL GROWTH NEED STRENGTH</u>	5.92	5.77	6.00	5.87	5.87
<u>MOTIVATING POTENTIAL SCORE (MPS)</u>	152	109	141	142	141

(\* = category containing statistically different means)

Note: 1) The USAF navigator means are based on the responses of 74 navigators in all flying commands.

Note: 2) Mission-differentiated navigator means are based on the following numbers of categorized responses: 1) = 8; 2) = 16; 3) = 28; 4) = 17; 5) = 5.

LEGEND:

- 1 TACTICAL AIRLIFT
- 2 TANKER/STRATEGIC AIRLIFT
- 3 STRATEGIC BOMBER
- 4 TACTICAL FIGHTER/RECONNAISSANCE
- 5 TEST/SPECIAL OPERATIONS

all seven job characteristics and the tanker/strategic airlift group ranked either last or next to last in five out of the seven categories (Table 7).

Investigative Question 4:

4. Based upon analysis of the above measures, is there a need for redesign of the entire navigator career field or only selected segments of the population? If a need for redesign is documented, what is the potential for accomplishing a job redesign in the identified group (Dotson and Hilbun, 1985:3)?

Previous explanations and analyses have been provided in this chapter to explain why navigators rate their specialty a particular way and will not be reviewed here. The purpose of this section is to pull all of the previously discussed data and analysis together in a concise framework that specifically addresses the question of job redesign in the navigator career field.

In order to answer the investigative question above, the step-by-step approach explained in Chapter III was used. First, the need for redesign was assessed by reexamining the comparison of the affective outcomes portion of the aggregate navigator means and the national norms for professional workers. According to Hackman and Oldham, "If the responses of employees indicate that motivation and satisfaction are near or below the national averages for these scales, then one would proceed to the next diagnostic step" (Hackman and Oldham, 1980:111). Conversely, if all of the means are above the norms, then any problems existing probably have little to do with internal work motivation, and work redesign may not be appropriate.

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TABLE 8

AFFECTIVE OUTCOMES COMPARISON:  
USAF (AGGREGATE) NAVIGATOR MEANS VS. NORMS (PROFESSIONALS)

<u>AFFECTIVE OUTCOMES</u>	<u>NORM</u>	<u>(AGGREGATE) NAVIGATOR</u>
General satisfaction	4.90	5.13
Internal work motivation	5.80	5.78
Growth satisfaction	5.10	4.78 *

(\* = Mean statistically lower than the norm)

(\*\* = Mean statistically higher than the norm)

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Table 8 illustrates that all three scores are either average or below average when compared to the national norms for these variables. Thus, the methodology in this case calls for proceeding to the next diagnostic step since a need for redesign cannot be ruled out. The low growth satisfaction score is significant and was previously discussed in this chapter. It is also important to note that Dotson and Hilbun's findings concerning affective outcome scores for SAC navigators were similar to those in Table 8.

The second step of the methodology, the comparison of the navigator (aggregate) motivating potential score (MPS) with the norm, was previously examined and discussed in this chapter. Table 9 illustrates that comparison.

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TABLE 9

MOTIVATING POTENTIAL SCORE COMPARISON:  
USAF (AGGREGATE) NAVIGATOR MEANS VS. NORMS (PROFESSIONALS)

	<u>NORM</u>	(AGGREGATE) <u>NAVIGATOR</u>
<u>MOTIVATING POTENTIAL SCORE</u>	154	135.6

(\* = Mean statistically lower than the norm)  
(\*\* = Mean statistically higher than the norm)

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Although the aggregate USAF navigator score is obviously smaller than the norm (arithmetically), the previously described statistical analysis (T-test) found no significant difference between the two means. According to Hackman and Oldham, a low MPS score in conjunction with some of the potential problems already discussed would lead one to conclude that the work itself could be the problem. Conversely, if the MPS was found to be high, "then it would be advisable to look to other aspects of the work situation (such as supervision, compensation, or co-worker relations) as possible causes of the observed difficulties" (Hackman and Oldham, 1980:111). Because neither of these alternatives were obtained in comparing the two means, the results were still inconclusive and the next diagnostic step was required to make a decision about the need for redesign. At this point in their methodology, Dotson and Hilbun found the MPS of SAC navigators to be significantly lower than the mean, thereby

differing considerably from this research and casting doubt on the applicability of their findings to all Air Force navigators.

The third and final step in determining the need for job redesign of the navigator specialty is the examination of the seven core characteristics in order to determine what aspects of the job most need improvement. This examination was previously accomplished in this chapter and the results are summarized in Table 10.

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TABLE 10

JOB CHARACTERISTICS COMPARISON:  
USAF (AGGREGATE) NAVIGATOR MEANS VS. NORMS (PROFESSIONALS)

<u>JOB CHARACTERISTICS</u>	<u>NORMS</u>	<u>(AGGREGATE) NAVIGATORS</u>
Skill variety	5.40	5.23
Task identity	5.10	4.97
Task significance	5.60	5.58
Autonomy	5.40	4.59 *
Feedback	5.10	5.29
Feedback from agents	4.20	4.60 **
Dealing with others	5.80	6.14 **

(\* = Mean statistically lower than the norm)

(\*\* = Mean statistically higher than the norm)

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Autonomy can be readily seen as an overall navigator problem area because it is significantly below the norm for that category. In addition to autonomy, Dotson and Hilbun found skill variety to be significantly below the norms, thereby diverging even further from the findings of this research.

According to Hackman and Oldham, "After the steps above have been addressed, it should be clear whether work redesign is a sensible change strategy for the group under study and, if so, just what aspects of the existing job should be the prime targets for change" (Hackman and Oldham, 1980:115).

Considering the findings discussed above in the context of Hackman and Oldham's statement, job redesign for the entire Air Force navigator career field was not indicated as the best course of action (as opposed to the findings of Dotson and Hilbun). Foremost in this decision was the relatively high MPS score (statistically equal to the norm) that was obtained as an aggregate measure of motivation potential for the entire survey group. This score indicates that there is at least a minimally adequate fit between Air Force navigators and their career specialty. Another supporting argument for not subjecting the entire navigator specialty to a redesign effort was the six (out of seven) average or above average scores obtained on the core job characteristics. Finally, navigators equalled the national norms in the areas of general job satisfaction and internal work motivation, leaving only growth satisfaction below the average.

If the navigator career field does not require an overall redesign, does this indicate that the identified problem areas are not significant? On the contrary, the previously discussed areas of autonomy and growth satisfaction affect the perceptions of Air Force navigators in general and most of the identified navigator sub-groups. Hackman and Oldham believe that those

factors that constrain the motivating characteristics of a job must be dealt with if a particular group's true potential is to be reached (Hackman and Oldham, 1980:117). Additionally, the significantly low scores in the two context satisfactions (pay and job security) are areas that must be addressed in order for navigators to reach a higher level of internal work motivation. As moderating variables, pay and job security do not directly affect the motivating potential of a job. They do, however, tend to be dissatisfiers that have a negative effect on the overall level of job satisfaction. In essence, these variables act as "spoilers" that must be satisfied if the correct environment for the promotion of internal work motivation is to occur (Hackman and Oldham, 1980:86-88).

If job redesign is unnecessary for the entire navigator population, are there any identified navigator sub-groups for which it is required? In order to consider all of the navigator sub-groups for possible redesign, an analysis similar to that completed for the aggregate group was performed on the aircraft and mission-differentiated groups. Table 11 summarizes specific variables of interest from the aircraft-differentiated groups which are required to make a job redesign decision. The affective outcomes were all found to be statistically equivalent to the national norms and with each other. It is important to note, however, that the growth satisfaction level for multi-place navigators was below (arithmetically) the aggregate navigator mean for that variable ( $4.64 < 4.78$ ). Moreover, the aggregate



mean for all USAF navigators was determined to be statistically below the norm for the same variable. This apparent contradiction occurred because of the division of the aggregate navigator group into the smaller groups used for the multiple comparisons. These smaller samples made the various T-tests and multiple comparison of means tests less powerful and less able to determine a statistical difference. In the particular case of growth satisfaction, however, the fact that the growth satisfaction level for multi-place navigators was much lower (arithmetically) than the norm and that fighter navigators were equal to the norm, illustrates that a probable difference does exist. A decision to redesign either group based on this marginal evidence was not warranted until the last two steps of the analysis were completed.

The second part of this analysis, a comparison of MPS values, found no significant differences among the means, indicating that a redesign would probably not be warranted for either group. Despite this finding, the final part of the analysis was conducted by examining the critical job characteristics. Once again, autonomy was found to be a significant problem area for all of the observed navigator groups as both multi-place and fighter navigators measured significantly below the norm on this variable. Skill variety and task significance were statistically higher in the fighter group, but the multi-place group was not determined to be statistically

below the mean in either measure. Reasons for these differences were previously described earlier in this chapter.

Based on the findings discussed above in the context of Hackman and Oldham's Job Characteristics Model (JCM), job redesign for either aircraft-differentiated navigator sub-group was not indicated as the best course of action. Reasons for such a decision were based on the lack of hard statistical evidence in the growth satisfaction area, the virtual equality of MPS scores, and the below average autonomy scores in both groups. Moreover, these findings were quite similar to those identified in the aggregate navigator comparison with the national norms, further substantiating the decision not to redesign.

Beyond the basic decision not to redesign these two navigator sub-groups, what is the significance of the generated results? Despite the common perception about their jobs in the area of autonomy, the two groups probably possess more differences than similarities. Previous analysis revealed that, arithmetically, fighter-type navigators obtained higher scores on five of the seven core job characteristics, all three of the affective outcomes, individual growth need strength (GNS), and the motivating potential score (MPS). Multi-place navigators generated higher arithmetic scores (none significant) in two of the seven job characteristics and all four of the context satisfactions (pay, job security, co-workers, supervisors). The means for co-workers and supervisors, however, were so close

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TABLE 11

JOB CHARACTERISTICS COMPAPISON:  
MULTI-PLACE NAVIGATORS, FIGHTER-TYPE NAVIGATORS, & NORMS

	<u>MULTI-PLACE NAVIGATORS</u>	<u>FIGHTER-TYPE NAVIGATORS.</u>	<u>NORMS</u>
<u>JOB CHARACTERISTICS.</u>			
Skill variety	4.95	5.64 **	5.40
Task significance	5.29	6.01 **	5.60
Autonomy	4.54 \$	4.66 \$	5.40
<u>AFFECTIVE OUTCOMES</u>			
Growth satisfaction	4.64	4.98	5.10
<u>MOTIVATING POTENTIAL SCORE (MPS)</u>	131.9	140.9	154

(\*\* = statistically higher than the Multi-place mean)  
(\$ = norm statistically higher than aircraft mean)

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between the groups that a rounding error on either of them could have resulted in the fighter group having the higher score. The significance of these additional observations in conjunction with the two significant job characteristics is that higher levels of internal work motivation and job satisfaction seem to be associated with the fighter group as opposed to the multi-place group, despite a lack of "hard" statistical evidence.

The third and final job enrichment analysis was performed on the five mission-differentiated navigator groups. Table 12 summarizes those previously determined results that are necessary to make a job redesign decision. Three variables were found to possess means that were statistically lower than the national

averages. First, growth satisfaction (Affective outcomes) among tanker/strategic airlift navigators (Group 2) was assessed to be significantly less than the national norm. Second, task significance was also found to be less than the norm in the tanker/strategic airlift group. Additionally, the strategic bomber group (Group 3) was determined to be statistically higher than the tanker/strategic airlift group in the area of task significance. Third, autonomy scores were rated below the norm in the tanker/strategic airlift, strategic bomber, and tactical fighter groups. Of those three groups, the tanker/strategic airlift group received the lowest overall arithmetic score in this category. Finally, although none of the MPS scores were considered to be different from the norm, the tanker/strategic airlift score was the smallest (arithmetically) of all MPS scores calculated in this or Dotson and Hilbun's research. Reasons for these differences were discussed earlier in this chapter.

Based on the findings illustrated above in conjunction with the analysis discussed throughout Chapter IV, job redesign was indicated as the best course of action for the tanker/strategic airlift group. This decision was based on significant scores below the national average: skill variety, task identity, and autonomy (job characteristics); growth satisfaction (affective outcomes); job security and pay (context satisfactions). Another important consideration in this decision was the relatively low MPS score achieved by the tanker/strategic airlift group. Despite the fact that it was not considered statistically

significant, the Group 2 MPS score was important due to its ability to convey an overall picture of the career field's motivating potential. As previously discussed, context satisfactions are not directly associated with higher levels of job satisfaction or work motivation. Rather, they act as

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TABLE 12

JOB CHARACTERISTICS COMPARISON:  
MISSION-DIFFERENTIATED CATEGORIES & NORMS

<u>JOB CHARACTERISTICS</u>	1	2	3	4	5
* Task identity	5.75	5.11	5.13	4.39	4.40
* Task significance \$(5.60)	5.50	4.83	5.90	5.73	5.80
Autonomy \$(5.40)	5.00	4.15	4.50	4.76	5.20
<u>AFFECTIVE OUTCOMES</u>					
General satisfaction	5.08	4.90	5.28	5.18	4.93
Internal work motivation	5.94	5.78	5.71	5.96	5.40
Growth satisfaction \$(5.10)	5.03	4.35	4.93	4.71	5.20

<u>MOTIVATING POTENTIAL SCORE (MPS)</u>	152	109	141	142	141
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(\* = category containing statistically different means)  
 (\$(NORM) =category containing means statistically less than norm)

LEGEND:

- 1 TACTICAL AIRLIFT
- 2 TANKER/STRATEGIC AIRLIFT
- 3 STRATEGIC BOMBER
- 4 TACTICAL FIGHTER/RECONNAISSANCE
- 5 TEST/SPECIAL OPERATIONS

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"spoilers" that prevent higher levels of satisfaction with the job from occurring. Although not statistically below the average

on any of these variables, the tanker/strategic airlift group was low enough (arithmetically) on pay and job security to consider them as probable areas of concern.

Other mission-differentiated groups achieved scores similar to or superior to the aggregate Air Force navigator group and are, therefore, not in need of a complete job restructuring. Strengths and areas of concern in each of the other four mission-differentiated groups were reviewed and are listed below.

1. Tactical Airlift: C-130 navigators were found to score significantly higher than the fighter and test groups in the area of task identity; C-130 navigators also scored statistically higher than the bomber and fighter groups on pay satisfaction; no variables assessed to be below the national norms.
2. Tanker/Strategic Airlift: Described above.
3. Strategic Bomber: Bomber navigators scored significantly higher on task significance than did the tanker/strategic airlift group; scored significantly below the norms in autonomy, job security, and pay.
4. Tactical Fighter/Reconnaissance: Fighter navigators did not score higher than any other group or norm (statistically); scored significantly below the tactical airlift navigators in task identity; scored significantly below the norms in autonomy and pay.
5. Test/Special Operations: Test/Special Ops navigators scored arithmetically higher than any groups on autonomy and growth satisfaction; scored significantly below tactical airlift group in task identity; scored significantly below the norm on job security.

After establishing the need for a redesign of the tanker/strategic airlift group, this research examined the feasibility of such an effort in accordance with the described methodology. First, employee readiness for change was ascertained by the growth need strength (GNS) measure from the

IDS. In the case of the tanker/strategic airlift group, the GNS was assessed to be 5.77, compared to a national norm of 5.60. By this measure alone, this group of navigators would respond favorably to a job redesign effort. Specifically, the GNS score indicates a desire for growth or change within the specialty (Dotson and Hilbun, 1985:48).

The next step in establishing the overall feasibility of job redesign is an examination of all four context satisfactions in relation to the national norms. As previously described in this chapter, this particular navigator group has no context satisfaction categories that are statistically lower than the norm. However, both pay satisfaction and job security are arithmetically below the norms and close to being statistically significant. Because the navigators of this group are somewhat concerned about two of the context satisfactions, any redesign effort that does not change the pay and job security situations may result in little or no improvement in job satisfaction and motivation. Either one of these variables can act as a "spoiler" and preoccupy the targeted group with negative feelings toward their work environment, thereby preventing the full development of the group's motivational potential.

The final step in establishing the feasibility of a job redesign deals with the organization's willingness to accept change. The three properties explained in Chapter III were considered in answering this question: the technological system, the personnel system, and the control system. In terms of the

tanker/strategic airlift group, problem areas included skill variety, task significance, autonomy, and growth satisfaction. Although not statistically significant, pay and job security were also deemed as potential problems because of the marginal scores received. According to Dotson and Hilbun, "Certain aspects of the technological, personnel, and control systems within Air Force flying organizations would constrain these changes" (Dotson and Hilbun, 1985:53). The technological aspect of this particular group's problems has already been discussed at length. Navigation systems, like most technology today, have become increasingly sophisticated, reliable, and accurate. These sophisticated systems have generally reduced the importance of navigation skills as applied on most Air Force aircraft. In aircraft with a high altitude, basic navigation mission (tankers, strategic airlifters), skill variety, task significance, and autonomy have been markedly reduced by this improving technology. Actual navigator reductions have occurred in such aircraft as the C-141 and C-5 aircraft due to the installation of more sophisticated inertial navigation systems. Additionally, the KC-135 tanker navigators have been subjected to many rumors over the years concerning the fate of their career specialty. The navigators in these aircraft understandably develop decreased levels of growth satisfaction and job security.

From a personnel standpoint, the job descriptions of all navigators define them as performing a support role to the pilot. In essence, as skills needed to accomplish certain navigator



missions become less crucial, and as operational mission command opportunities decrease, tanker/strategic airlift navigators will not experience the necessary levels of autonomy and growth satisfaction that increase work motivation. This, in turn, leads to feelings of being "second class citizens" in relation to pilots. Moreover, the issue of the pilot incentive bonus and the subsequent effect on pay satisfaction only serves to heighten the negative feelings of navigators toward their work environment.

Finally, the control system as applied to navigators has also been discussed previously in this chapter as adherence to the numerous regulations, manuals, checklists, and rules of engagement. Based on the critical nature of the flying mission in the US Air Force and the need for discipline in wartime, certain aspects of any rated position can probably be expected to be "untouchable" in terms of job redesign. Additionally, the new Officer Evaluation System (OES) is viewed by some of these navigators as a preferential promotion vehicle to keep pilots in the Air Force.

### Summary

This chapter comprehensively presented the survey data in accordance with the methodology described in Chapter III. The broad objectives of the research were accomplished and the four investigative questions that tested the hypotheses were answered. Specific areas discussed in the chapter were the level of survey response and the findings and analysis section.

## V. Conclusions and Recommendations

Based on the findings and analysis of this research in the context of the original framework, conclusions were formulated and assigned to one of three categories: General Conclusions (All Navigators); Aircraft-Differentiated Conclusions; and Mission-Differentiated Conclusions. Recommendations to resolve some of the major areas of concern were also developed within the same framework and are listed after the conclusions.

### General Conclusions (All Navigators)

A job redesign of the entire Air Force navigator specialty is not indicated as the best course of action for improving the internal work motivation of that group. The navigator career field has a motivating potential equivalent to the national average. Moreover, navigators possess relatively high needs for growth and development that could enhance any future attempts at improving the navigator working environment.

Despite the conclusion above, problems in the navigator career specialty do exist and require attention if this group of officers is to reach its full potential. As an aggregate group, Air Force navigators scored below the national norms in the areas of autonomy, growth satisfaction, job security, and pay satisfaction.

The problem of autonomy results in part from the required use of regulations, checklists, and the extensive procedures

associated with flying. The main contributor to low autonomy scores, however, appears to be the institutionalization of the regulation-defined, pilot support role. This role keeps navigators from ever being "air leaders" and, thus, does not permit them the opportunity to make their own decisions.

Problems in growth satisfaction among navigators result from the perception (81% of survey respondents) that pilots receive a disproportionate share of the "good" jobs (flight commander, operations officer, commander) simply because of their rating. This, in turn, leads to lower promotion rates for navigators (1989 lieutenant colonel promotion board results) and a perception that the only way for navigators to obtain growth is outside of the operational flying environment.

Low scores on job security among navigators appear to be a reflection of the continuing trend toward fewer and fewer navigators in the US Air Force. A large majority (61%) of the survey respondents foresaw the probable elimination of the navigator career field in the near future.

Pay satisfaction is a major source of negative feelings among Air Force navigators due to the perception of unfairness associated with the recently created pilot incentive bonus. Over 84% of the survey group perceived the bonus as a flawed concept that weakens crew integrity and reinforces the notion of the navigator as a "second class citizen."

Comparisons of the attitudes of Air Force navigators with those of Strategic Air Command (SAC) navigators in a previous

study illustrate that the navigator career field is not a homogeneous entity. Due to significantly low scores in the overall motivating potential and task significance of the job, the authors of the SAC study concluded that job redesign of the SAC navigator specialty was necessary due to a general lack of fit between the individual and the job. While probably correct as an aggregate measure of job satisfaction in SAC, the previous study did not accurately reflect the feelings of many navigators in the Strategic Air Command or the Air Force.

#### Aircraft-Differentiated Conclusions

Based on the findings of this research, job redesign for either aircraft-differentiated navigator sub-group is not warranted as a method of improving job satisfaction and work motivation among the groups. Both the fighter-type and multi-place navigator career fields have motivation potential and growth satisfaction statistically equivalent to the national average.

Higher levels of internal work motivation and job satisfaction seem to be associated with the fighter group as opposed to the multi-place group. This assessment is based on statistically higher scores in two important job characteristics categories and a general trend of higher scores on ten out of the sixteen variables of the Job Diagnostic Survey (JDS).

Fighter-type navigators generate significantly higher scores in the areas of skill variety and task significance than do

multi-place navigators. Much of this stems from the fact that navigators in fighters must act as co-pilots, weapons officers, and electronic warfare officers while simultaneously completing their navigation duties. Thus, the term "navigator" is often considered to be an inappropriate term in certain flying commands and the US Navy because navigation is only a small portion of the individual's duties.

Multi-place navigators receive lower scores in skill variety and task significance than do fighter navigators because the multi-place navigators are often mutually supported by other crewmembers who are able to accomplish some of the same functions, thereby reducing the level of the job's significance. This lack of indispensability, in conjunction with improved navigation systems, often leads to feelings of insignificance on the part of those navigators who are primarily concerned with getting an aircraft from one geographical point to another.

In terms of the original hypothesis, no real difference was found to exist in the autonomy levels of the two groups. Surprisingly, being assigned to a fighter with only two people working together does not promote higher levels of autonomy than that found in the multi-place environment. This result can probably be attributed to the strength and commonality of the various controlling mechanisms (checklists, manuals, procedures) that were previously discussed.

### Mission-Differentiated Conclusions

An examination of navigator job attitudes by mission type proved most useful in narrowing the focus to those groups with acute job satisfaction problems. As a result, job redesign is indicated as the best course of action for only one of the five mission groups: tanker/strategic airlift. This decision is based on significant scores below the national average: skill variety, task identity, autonomy, growth satisfaction, job security, and pay.

Many of the problems associated with the tanker/strategic airlift group are reflections of the relationship between the type of mission performed and changes in technology. Sophisticated navigation systems have generally reduced the importance of navigation skills as applied in most Air Force aircraft. In aircraft with a high altitude, basic navigation mission (tankers, strategic airlifters), skill variety, task significance, and autonomy have been markedly reduced by this improving technology. Additionally, actual reductions of navigators have occurred in certain strategic airlifters while tanker navigators have been subjected to many rumors over the years concerning the fate of their career specialty. The navigators in these aircraft understandably develop decreased levels of growth satisfaction and job security.

Tactical airlift (C-130) navigators are more satisfied with their jobs than any other group. Having no variables assessed to be below the national norms, these navigators strongly identify

with their mission and the role they play in it. A lack of modern navigation equipment and the obscure places to which they sometimes fly make the navigators on the C-130 the last group of true "navigators" in the Air Force.

Strategic bomber navigators score highest in the area of task significance due to the perceived importance of their mission and the contributions they make to it. These findings about this group are important because the bomber category is composed of both multi-place (B-1, B-52) and fighter aircraft (FB-111). Thus, the type of mission a navigator flies appears to be more important than the type of aircraft in determining the significance of the work performed. Areas below the national average for this group are autonomy, job security, and pay.

The tactical fighter/reconnaissance group can best be characterized by a lack of either high or low scores on most of the variables. Generally speaking, this group parallels the attitudes of the strategic bomber navigators and, as such, is extremely sensitive to the issue of pay satisfaction and the pilot incentive bonus. Because both the tactical and strategic navigators perceive their roles as significant and essentially equal to that of the pilot, the pilot bonus evokes the most negative feelings among these navigators.

Test/special operations navigators scored arithmetically higher than any of the other groups on autonomy and growth satisfaction. These results are not surprising since this group is very small and generally exercises much more discretion and

flexibility than the average line navigator. Navigators in this group, however, exhibit the same negative feelings of job security that are exhibited by the aggregate Air Force group.

### Recommendations

This study involved the comprehensive measurement and comparison of the job characteristics levels of navigators found throughout the Air Force. It was never intended to develop a program of job enrichment for the navigator career field or any other sub-group. In light of this intention, the recommendations for correcting the problems discussed in this research are broad-based and applicable in a general sense. Detailed solutions for job enrichment in the tanker/strategic airlift group or any other navigator sub-group should be developed as possible topics for future research in this area.

Throughout this research, four specific problem areas have been identified as applicable to most of the navigator population of the US Air Force: autonomy, growth satisfaction, job security, and pay satisfaction. Of these four factors, three of them (autonomy, growth satisfaction, and pay) seem to be directly rooted in the relationship that has evolved over the years between navigators and pilots. The basis of this relationship is the delineation of duties and definition of the navigator role that is contained in flying regulations and technical orders. These publications define the navigator role as one of support to the pilot and institutionalize the concept of the aircraft



commander as the individual in charge of all aspects of the "air mission." This institutionalization of the two different roles allows pilots to make command decisions from the very beginning of their careers while navigators are rarely given the opportunity to do so even at much later stages of their careers. As this study has shown, this lack of ability to make decisions is a primary cause of the low autonomy scores found in almost every navigator group.

The second problem area that results from this navigator-pilot delineation is one of growth satisfaction. Once again, navigators see the grooming of pilots for command positions beginning very early in a pilot's career. This leads to the feelings among many navigators that they cannot fairly compete with pilots for the desirable mid-level and command positions that gain one promotions to the higher ranks. The poor results that navigators experienced in the 1989 lieutenant colonel promotion board are pointed to as an illustration of this institutional bias against navigators. Thus, these same navigators feel that the only way to obtain growth and increased responsibility is to seek opportunities outside of operational flying units.

Pay satisfaction, the third and final problem area that is part of the overall navigator-pilot relationship, was not a problem until the proposal was made to retain pilots in the Air Force by offering them substantial incentive bonuses. Now that the bonus is a reality, however, it often evokes the most

critical responses of any issue. As previously discussed in this research, 64 of the 74 survey respondents (86%) mentioned the pay issue as a major source of dissatisfaction among navigators. Navigators tend to view this issue as one of fairness and believe that crew integrity has been greatly affected as a result. In a broader sense, the pay issue has developed because it has reinforced the notion among many navigators that they are really "second class citizens." Based on the author's experience and the responses of those surveyed, it is this perception of giving the pilot community one more advantage over navigators that has energized pay satisfaction as an issue. This is not to say that the bonus would be accepted if navigators viewed themselves as having the same opportunities for growth as pilots. On the contrary, the pilot bonus would still be viewed as unfair; however, the degree of dissatisfaction would likely be greatly reduced.

In order to affect these negative perceptions among navigators, some fundamental changes in the pilot-navigator relationship must take place. The concept of the aircraft commander as it exists today must be redefined. Specifically, the pilot is an aviator who has been trained to perform a very specialized skill. He/she is the expert on the flight control systems and any other systems that involve keeping the aircraft safely flying and intact. Because of this expertise, the pilot must necessarily be the individual responsible for making decisions concerning the safe operation of the aircraft. Air

Force directives, however, have also given the pilot the overall responsibility for being the "air leader" or mission commander, presumably to centralize overall control. A question many navigators ask concerning this assignment of responsibility is, why should the pilot always be in charge of all aspects of a mission simply because he/she controls the aircraft? A second question often asked is, should not the senior ranking aviator be in charge of mission accomplishment as opposed to the person wearing pilot's wings? The implication of these questions is that either a navigator or pilot could be given mission commander status depending on the rank structure of the crew. It is important to reemphasize, however, that the pilot would always maintain his/her aircraft commander status, but would defer to the senior aviator on board in terms of mission accomplishment.

A redefinition of the pilot-navigator relationship appears, at first, to be a radical departure from the traditions of military discipline and control. In terms of the traditional concept of the senior ranking individual being given responsibility for overall mission accomplishment, the current Air Force policy of allowing the pilot to make all command decisions (regardless of rank) is probably more of an exception than is a redefinition of roles. The air arm of the US Navy uses its navigator equivalents as mission commanders based on the long-held, shipborne tradition of giving the senior ranking officer on board overall responsibility for command. If Air Force directives were rewritten to permit this type of

responsibility to be given to all aviators, navigators would feel more pride in themselves and their career field. The problem areas of autonomy and growth satisfaction would begin to rise toward the national norms as navigators experienced more opportunities to make decisions and compete fairly for the better positions. The issue of pay satisfaction and the pilot bonus would still exist, but would probably stir less resentment if navigators felt that they were being judged on the basis of their abilities and not their style of wings.

The fourth problem area, job security, is a difficult one because the role of the navigator in future weapons systems is not an optimistic one. Certain missions as they are defined today (high altitude, point to point navigation) are gradually being replaced by sophisticated computer systems. Tanker/strategic airlift navigators generally fly such profiles. Other missions, such as tactical airlift and tactical fighter-bomber operations, will probably continue to employ navigators due to the complexity of low level operations and weapons delivery. The number of positions in these fields, however, will be reduced because the number of new aircraft the Air Force buys to replace older systems is generally less due to increasing unit costs and budget pressures. In essence, navigators will continue to be a part of the flying mission for the foreseeable future, though in smaller numbers and in selected weapons systems. Thus, the recommendations for increased navigator responsibility described above are still applicable to the future aviation force.

This research has examined numerous aspects of navigator job satisfaction and internal work motivation. Possible future areas of related study could include: the development of an actual job enrichment plan for the tanker/strategic airlift group; a reexamination of the same issues using a different survey instrument, such as the Job Characteristics Inventory (JCI); a comparison of job attitudes among navigators in the US Air Force and US Navy to determine if the concept of the mission commander does make a difference in overall job satisfaction; and a possible examination of pilot attitudes and perceptions regarding the present and future role of navigators in the US Air Force.

#### Summary

This chapter represented the culmination of this research effort to measure and compare job characteristics levels of Air Force navigators. Conclusions were formulated and assigned to one of three groups: general conclusions, aircraft-differentiated conclusions, and mission-differentiated conclusions. Additionally, general recommendations for correcting the problems discussed in this research were described as were potential areas of future study.

Appendix A: Job Diagnostic Survey (JDS)

PRIVACY ACT STATEMENT

In accordance with paragraph 30, AFR 12-35, the following information is provided as required by the Privacy Act of 1974:

a. Authority:

(1) 5 U.S.C 301, Departmental Regulations; and/or

(2) 10 U.S.C.  
8012, Secretary of the Air Force, Powers, Duties, Delegation by Compensation; and/or

(3) DOD Instruction 1100.13, 17 Apr 68,  
Surveys of Department of Defense Personnel; and/or

(4) AFR 30-23, 22 Sep 76, Air Force Personnel Survey Program.

b. Principal purposes: The survey is being conducted to collect information to be used in research aimed at illuminating and providing inputs to the solution of problems of interest to the Air Force and/or DOD.

c. Participation in this survey is entirely voluntary.

d. No adverse action of any kind may be taken against any individual who elects not to participate in any or all of this survey.

1 Sep 89

## SECTION ONE

This part of the questionnaire asks you to describe your job as objectively as you can.

Please do not use this part of the questionnaire to show how much you like or dislike your job. Questions about that will come later. Instead, try to make your descriptions as accurate and objective as you possibly can.

This survey is being given to navigators/weapons systems officers (WSO) throughout the Air Force. If you have changed jobs and are not currently working as a crewmember, then please answer the questions in this survey based on your prior experience as a navigator/WSO.

A sample question is given below.

A. To what extent does your job require you to work with mechanical equipment?

1-----	2-----	3-----	4-----	5-----	6-----	7-----
Very little; the job			Moderately			Very much; the
requires almost no						job requires
contact with mechanical						almost constant
equipment of any kind.						work with
						mechanical
						equipment.

You are to circle the number which is the most accurate description of your job.

If, for example, your job requires you to work with mechanical equipment a good deal of the time--but also requires some paperwork--you might circle the number six, as was done in the example above.

Please turn the page and begin.

1. To what extent does your job require you to work closely with other people (either clients, or people in related jobs in your own organization)?

1-----2-----3-----4-----5-----6-----7		
Very little; dealing with other people is not at all necessary in doing the job.	Moderately; some dealing with others is necessary.	Very much; dealing with other people is an absolutely essential and crucial part of the job.

2. How much autonomy is there in your job? That is, to what extent does your job permit you to decide on your own how to go about doing the work?

1-----2-----3-----4-----5-----6-----7		
Very little; the job gives me almost no personal "say" about how and when the work is done.	Moderate autonomy; many things are standardized and not under my control, but I can make some decisions about the work.	Very much; the job gives me almost complete responsibility for deciding how and when the work is done.

3. To what extent does your job involve doing a "whole" and identifiable piece of work? That is, is the job a complete piece of work that has an obvious beginning and end? Or is it only a small part of the overall piece of work, which is finished by other people or by automatic machines?

1-----2-----3-----4-----5-----6-----7		
My job is only a tiny part of the overall piece of work; the results of my activities cannot be seen in the final product or service.	My job is a moderate-sized "chunk" of the overall piece of work; my own contribution can be seen in the final outcome.	My job involves doing the whole piece of work, from start to finish; the results of my activities are easily seen in the final product.



4. How much variety is there in your job? That is, to what extent does the job require you to do many different things at work, using a variety of your skills and talents?

1-----2-----3-----4-----5-----6-----7		
Very little; the job requires me to do the same routine things over and over again.	Moderate variety.	Very much; the job requires me to do many different things, using a number of different skills and talents.

5. In general, how significant or important is your job? That is, are the results of your work likely to significantly affect the lives or well-being of other people?

1-----2-----3-----4-----5-----6-----7		
Not very significant; the outcomes of my work are <u>not</u> likely to have important effects on other people.	Moderately significant.	Highly significant; the outcomes of my work can affect other people in very important ways.

6. To what extent do managers or co-workers let you know how well you are doing on your job?

1-----2-----3-----4-----5-----6-----7		
Very little; people almost never let me know how well I am doing.	Moderately; sometimes people may give me "feedback"; other times they may not.	Very much; managers or co-workers provide me with almost constant "feedback" about how well I am doing.

7. To what extent does doing the job itself provide you with information about your work performance? That is, does the actual work itself provide clues about how well you are doing--aside from any "feedback" co-workers or supervisors may provide?

1-----2-----3-----4-----5-----6-----7		
Very little; the job itself is set up so I could work forever without finding out how well I am doing.	Moderately; sometimes doing the job provides "feedback" to me; sometimes it does not.	Very much; the job is set up so that I get almost constant "feedback" about how well I am doing.

## SECTION TWO

Listed below are a number of statements which could be used to describe a job.

You are to indicate whether each statement is an accurate or inaccurate description of your job.

Once again, please try to be as objective as you can in deciding how accurately each statement describes your job--regardless of whether you like or dislike your job.

Write a number in the blank beside each statement, based on the following scale:

How accurate is the statement in describing your job?

1	2	3	4	5	6	7
Very	Mostly	Slightly	Uncertain	Slightly	Mostly	Very
<-----INACCURATE-----> <-----ACCURATE----->						

- \_\_\_1. The job requires me to use a number of complex or high-level skills.
- \_\_\_2. The job requires a lot of cooperative work with other people.
- \_\_\_3. The job is arranged so that I do not have the chance to do an entire piece of work from beginning to end.
- \_\_\_4. Just doing the work required by the job provides many chances for me to figure out how well I am doing.
- \_\_\_5. The job is quite simple and repetitive.
- \_\_\_6. The job can be done adequately by a person working alone--without talking or checking with other people.
- \_\_\_7. The supervisors and co-workers on this job almost never give me any "feedback" about how well I am doing in my work.
- \_\_\_8. This job is one where a lot of other people can be affected by how well the work gets done.
- \_\_\_9. The job denies me any chance to use my personal initiative or judgment in carrying out the work.
- \_\_\_10. Supervisors often let me know how well they think I am performing the job.

- \_\_\_11. The job provides me the chance to completely finish the pieces of work I begin.
- \_\_\_12. The job itself provides very few clues about whether or not I am performing well.
- \_\_\_13. The job gives me considerable opportunity for independence and freedom in how I do the work.
- \_\_\_14. The job itself is not very significant or important in the broader scheme of things.

### SECTION THREE

Now please indicate how you personally feel about your job.

Each of the statements below is something that a person might say about his or her job. You are to indicate your own, personal feelings about your job by marking how much you agree with each of the statements.

Write a number in the blank for each statement based on this scale:

How much do you agree with the statement?

1	2	3	4	5	6	7
Disagree	Disagree	Disagree	Neutral	Agree	Agree	Agree
Strongly		Slightly		Slightly		Strongly

- \_\_\_1. My opinion of myself goes up when I do this job well.
- \_\_\_2. Generally speaking, I am very satisfied with this job.
- \_\_\_3. I feel a great sense of personal satisfaction when I do this job well.
- \_\_\_4. I frequently think of quitting this job.
- \_\_\_5. I feel bad and unhappy when I discover that I have performed poorly on this job.
- \_\_\_6. I am generally satisfied with the kind of work I do in this job.
- \_\_\_7. My own feelings generally are not affected much one way or the other by how well I do on this job.

#### SECTION FOUR

Now please indicate how satisfied you are with each aspect of your job listed below. Once again, write the appropriate number in the blank beside each statement.

How satisfied are you with this aspect of your job?

1	2	3	4	5	6	7
Extremely		Slightly	Neutral	Slightly		Extremely
<-----DISSATISFIED-----> <-----SATISFIED----->						

- \_\_\_1. The amount of job security I have.
- \_\_\_2. The amount of pay and fringe benefits I receive.
- \_\_\_3. The amount of personal growth and development I get in doing my job.
- \_\_\_4. The people I talk to and work with on my job.
- \_\_\_5. The degree of respect and fair treatment I receive from my boss.
- \_\_\_6. The feeling of worthwhile accomplishment I get from doing my job.
- \_\_\_7. The chance to get to know other people while on the job.
- \_\_\_8. The amount of support and guidance I receive from my supervisor.
- \_\_\_9. The degree to which I am fairly paid for what I contribute to this organization.
- \_\_\_10. The amount of independent thought and action I can exercise in my job.
- \_\_\_11. How secure things look for me in the future in this organization.
- \_\_\_12. The chance to help other people while at work.
- \_\_\_13. The amount of challenge in my job.
- \_\_\_14. The overall quality of the supervision I receive in my work.

## SECTION FIVE

Listed below are a number of characteristics which could be present on any job. People differ about how much they would like to have each one present in their own jobs. We are interested in learning how much you personally would like to have each one present in your job.

Using the scale below, please indicate the degree to which you would like to have each characteristic present in your job.

NOTE: The numbers on this scale are different from those used in previous scales.

4	5	6	7	8	9	10
Would like			Would like			Would like
having this			having this			having this
only a moderate			very much			<u>extremely</u>
amount (or less)						much

- \_\_\_\_1. High respect and fair treatment from my supervisor.
- \_\_\_\_2. Stimulating and challenging work.
- \_\_\_\_3. Chance to exercise independent thought and action in my job.
- \_\_\_\_4. Great job security.
- \_\_\_\_5. Very friendly co-workers.
- \_\_\_\_6. Opportunities to learn new things from my work.
- \_\_\_\_7. High salary and good fringe benefits.
- \_\_\_\_8. Opportunities to be creative and imaginative in my job.
- \_\_\_\_9. Quick promotions.
- \_\_\_\_10. Opportunities for personal growth and development in my job.
- \_\_\_\_11. A sense of worthwhile accomplishment in my work.

SECTION SIX  
BIOGRAPHICAL DATA

All information in this section will be held in the strictest confidence; no one in your organization will have access to individual responses.

1. What is your current Air Force specialty code?

---

2. To what aircraft are you currently assigned?

---

3. How much total active commissioned service have you completed? (Check one)

- ☐ A. less than 6 years
- ☐ B. 6 but less than 8 years
- ☐ C. 8 but less than 10 years
- ☐ D. 10 but less than 12 years
- ☐ E. 12 or more years

4. What is your age? (Check one)

- ☐ A. 21-26
- ☐ B. 27-31
- ☐ C. 32-36
- ☐ D. 37-41
- ☐ E. Over 41

5. What is your sex? (Check one)

- ☐ A. Male
- ☐ B. Female

6. What is your marital status? (Check one)

- ☐ A. Married
- ☐ B. Not married

7. What is your highest education level? (Check one)

- ☐ A. College graduate
- ☐ B. Some graduate work
- ☐ C. Graduate degree

8. How long have you held your current AFSC?

\_\_\_\_\_

9. Do you have any prior-service (enlisted) time? If so, please state the total number of years served.

\_\_\_\_\_

10. Do you supervise others? (Check one)

\_\_\_\_\_A. Yes

\_\_\_\_\_B. No

11. If yes, how many personnel do you supervise? (Check one)

\_\_\_\_\_A. 5 or less

\_\_\_\_\_B. 6-10

\_\_\_\_\_C. 11-15

\_\_\_\_\_D. 16-20

\_\_\_\_\_E. 21-30

\_\_\_\_\_F. More than 30

\_\_\_\_\_G. None

12. Do you intend to stay in the Air Force beyond your present commitment? (Check one)

\_\_\_\_\_A. No, I am separating

\_\_\_\_\_B. No, I am retiring

\_\_\_\_\_C. Undecided

\_\_\_\_\_D. Yes

If the answer to this question is no or undecided, please answer the following question on the next page:





Appendix B: Scoring Key for the Job Diagnostic Survey

I. JOB CHARACTERISTICS

A. Skill variety. Average the following items:

Section One: #4  
Section Two: #1  
#5 (reversed scoring; i.e., subtract  
the number entered from 8)

B. Task identity. Average the following items:

Section One: #3  
Section Two: #11  
#3 (reversed scoring)

C. Task significance. Average the following items:

Section One: #5  
Section Two: #8  
#14 (reversed scoring)

D. Autonomy. Average the following items:

Section One: #2  
Section Two: #13  
#9 (reversed scoring)

E. Feedback from the job. Average the following items:

Section One: #7  
Section Two: #4  
#12 (reversed scoring)

F. Feedback from agents. Average the following items:

Section One: #6  
Section Two: #10  
#7 (reversed scoring)

G. Dealing with others. Average the following items:

Section One: #1  
Section Two: #2  
#6 (reversed scoring)

II. AFFECTIVE OUTCOMES. The first two constructs (general satisfaction and internal work motivation) are measured directly (Section Three); growth satisfaction is measured directly (Section Four).

A. General satisfaction. Average the following items:

Section Three: #2, #6  
#4 (reversed scoring)

B. Internal work motivation. Average the following items:

Section Three: #1, #3, #5  
#7 (reversed scoring)

C. Growth satisfaction. Average the following items:

Section Four: #3, #6, #10, #13

III. CONTEXT SATISFACTIONS. Each of these short scales uses items from Section Four only.

A. Satisfaction with job security. Average items #1 and #11 of Section Four.

B. Satisfaction with compensation (pay). Average items #2 and #9 of Section Four.

C. Satisfaction with co-workers. Average items #4, #7, and #12 of Section Four.

D. Satisfaction with supervision. Average items #5, #8, and #14 of Section Four.

IV. INDIVIDUAL GROWTH NEED STRENGTH. The questionnaire yields the measure of growth need strength from Section Five (the "would like" format).

A. "Would like" format (Section Five). Average the six items from Section Five listed below. Before averaging, subtract 3 from each item score; this will result in a summary scale ranging from one to seven. The items are:

#2, #3, #6, #8, #10, #11

V. MOTIVATING POTENTIAL SCORE.

$$\text{MPS} = \frac{\begin{array}{c} \text{Skill} \quad \text{Task} \quad \text{Task} \\ \text{variety} + \text{identity} + \text{significance} \end{array}}{3} \times \text{Autonomy} \times \begin{array}{c} \text{Job} \\ \text{feedback} \end{array}$$

Appendix C: Job Diagnostic Survey Score Comparison of Means:  
National Norms (Professional Workers) vs. SAC Navigators

	<u>NORMS</u>	<u>(SAC)</u> <u>NAVIGATORS</u>	
<u>JOB CHARACTERISTICS</u>			
Skill variety	5.40	5.02	*
Task identity	5.10	5.09	
Task significance	5.60	5.63	
Autonomy	5.40	4.28	*
Feedback	5.10	5.33	**
Feedback from agents	4.20	4.66	**
Dealing with others	5.80	6.33	**
<u>AFFECTIVE OUTCOMES</u>			
General satisfaction	4.90	4.95	
Internal work motivation	5.80	5.80	
Growth satisfaction	5.10	4.69	*
<u>CONTEXT SATISFACTIONS</u>			
Job security	5.00	4.45	*
Pay	4.40	4.96	**
Co-workers	5.50	5.55	
Supervision	4.90	4.96	
<u>INDIVIDUAL GROWTH NEED STRENGTH</u>	5.60	5.86	**
<u>MOTIVATING POTENTIAL SCORE (MPS)</u>	154	119	*

(\* = statistically lower than the norm)

(\*\* = statistically higher than the norm)

Note: 1) The norms for technical workers were compiled by Hackman, Oldham, and Stepina (1979). They are based on the responses of 500 employees who work in non-managerial positions (Hackman and Oldham, 1979:23).

Note: 2) The SAC navigator means were determined by Dotson and Hilbun (1985). They are based on the responses of 167 navigators in the Strategic Air Command (SAC) (Dotson and Hilbun, 1985:37).

Appendix D: Job Diagnostic Survey Score Comparison of Means:  
National Norms (Professional Workers) vs. USAF Navigators

	<u>NORMS</u>	<u>(USAF)</u> <u>NAVIGATORS</u>	
<u>JOB CHARACTERISTICS</u>			
Skill variety	5.40	5.23	
Task identity	5.10	4.97	
Task significance	5.60	5.58	
Autonomy	5.40	4.59	*
Feedback	5.10	5.29	
Feedback from agents	4.20	4.60	**
Dealing with others	5.80	6.14	**
<u>AFFECTIVE OUTCOMES</u>			
General satisfaction	4.90	5.13	
Internal work motivation	5.80	5.78	
Growth satisfaction	5.10	4.78	*
<u>CONTEXT SATISFACTIONS</u>			
Job security	5.00	4.21	*
Pay	4.40	3.98	*
Co-workers	5.50	5.36	
Supervision	4.90	4.75	
<u>INDIVIDUAL GROWTH NEED STRENGTH</u>	5.60	5.90	**
<u>MOTIVATING POTENTIAL SCORE (MPS)</u>	154	135.6	

(\* = statistically lower than the norm)

(\*\* = statistically higher than the norm)

Note: 1) The norms for technical workers were compiled by Hackman, Oldham, and Stepina (1979). They are based on the responses of 500 employees who work in non-managerial positions (Hackman and Oldham, 1979:23).

Note: 2) The USAF navigator means are based on the responses of 74 navigators in all flying commands.

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Vita

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The purpose of this study was to determine the job characteristics levels of US Air Force navigators as indicators of internal work motivation and job satisfaction. This research accomplished two broad objectives. First, navigator job characteristics in all flying commands throughout the Air Force were assessed to obtain an aggregate measure of that career field's work motivation. Second, the effects of aircraft type and mission performed on the job characteristics levels of different categories of Air Force navigators were examined in order to assess the possibility of varying attitudes within the career specialty.

Data was obtained from a popular survey instrument (Job Diagnostic Survey) and was interpreted in the context of behavioral/organizational theory.

Analysis of the survey data found that Air Force navigators, as an aggregate group, are equal to the national averages in most areas of job satisfaction. Despite the conclusion above, four major problem areas were found to be below the national norms: autonomy, growth satisfaction, job security, and pay satisfaction. The highest level of discontent was generated in the area of pay satisfaction almost entirely as a result of the pilot incentive bonus.

In terms of the aircraft-differentiated comparisons, fighter-type navigators seem to possess higher levels of internal work motivation and job satisfaction than do multi-place navigators. The mission-differentiated comparisons found tactical airlift navigators to be the most satisfied group overall while the tanker/strategic airlift group was found to be the most dissatisfied and in need of a job redesign.

This study recommended fundamental changes in the navigator-pilot relationship to include redefining the concept of the aircraft commander and allowing navigators to function as mission commanders as some navigators do in the US Navy. Moreover, possible future areas of related study were described.

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